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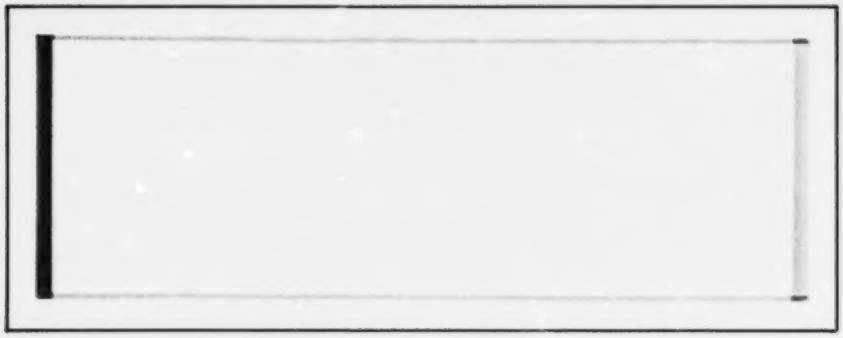

WORKING PAPER

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DAIRY POLICY SIMULATION AND EVALUATION*

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EXECUTIVE SUMMARY

This paper contains a description of a model designed to simulate the Canadian Dairy Industry from the farm gate to the consumer. The purpose of the model is to determine prices at the farm gate of the products produced by Canadian dairy farmers and provide a framework for the analysis of the effects of changes in dairy policy on the industry. The model takes production at the farm gate as predetermined but incorporates flexible consumer level demands for major classes of dairy products. The policy of supporting the prices for butter and skim milk powder interacts with processing costs to determine prices for milk constituents and the various dairy products. The model allows simulation of the effects of changing policy variables on such things as farm income and production, surplus skim milk powder, government expenditure and the utilization of processed dairy products in Canada.

The first section of the report contains a brief description of the dairy industry in Canada: the identifiably different products produced at the farm level; the processed dairy products sold at the retail level; and policy instruments used to influence milk production and maintain and stabilize the incomes of dairy producers.

A description of the analytical model follows in the second section. The analysis is based upon the simulation of the demand side of the dairy sector. It is possible to examine policy impacts from only the demand side because the effect of policy is to make the supply function perfectly inelastic for milk at the farm gate;

demand alone, therefore, determines market prices which interact with policy to determine farm income, government expenditures, and consumer impacts. In building the model support prices are used to estimate the value of milk at the farm gate and these in turn are compared with consumer prices to estimate farm gate to consumer unit margins. These margins are then used as the costs of conversion of milk into dairy products under various alternative scenarios in the framework of a linear programming model with demands structured following the method of Duloy and Norton. In the alternative scenarios farm gate to consumer unit margins are assumed to be constant except as they change over time due to inflation.

The results section contains results of the simulation of a base scenario and four policy alternative scenarios:

BASE. A "no change" alternative where support prices are increased at the rate of inflation and MSQ increases passively so that the nation is self-sufficient in butterfat.

1. Elimination of the special export quota.

2. An immediate elimination of the direct subsidy on butterfat, compensatory increases in support prices, and passive adjustments of MSQ;

3. A reduction of the direct subsidy, compensatory increase in support prices, and passive adjustments of MSQ; and

4. An increase in support prices (as in Scenario 3), a reduction of the quantity of milk eligible for the subsidy (MSQ), and butter imports used to balance butterfat demands.

The Base Scenario is treated as a standard for comparison with alternative scenarios. Scenario 3 and 4 are policy changes implemented.

Scenarios 1 and 2 represent policy changes implemented fully in 1985 and therefore are compared with the base scenarios for 1984 and 1985. For these two scenarios the adjustments to these policies are traced out and compared with base over the period 1984-88.

Results are presented to show the impact of the policy on dairy farmers as a whole, consumers, and on the taxpayer through government expenditure. The effect of policies on a particular dairy farmer will also depend upon how increases or decreases of industrial quota is assigned and his own costs of production. No attempt is made to esimate impacts at that level. Changes in production levels will also result in changes in employment, productivity and returns within the processing industry at least in the short run. No attempt is made to evaluate these effects.

Results for 1985 are summarized in Table 1. The base scenario for 1985 has a modest increase in milk production, gross farm income and net farm income despite a drop in the Butterfat Subsidy (in constant dollars only) and a rise in losses on exported surpluses of dairy products. Consumer demand grows at about one percent with prices stable in real terms but increasing in nominal terms at about the rate of inflation.

Scenarios 2-4 represent alternative approaches to reducing the butterfat subsidy. Scenario 2 allows for a large increase in the target support price (returns) over 1984. This scenario also entails substantial decreases in production, in net farm income, and probably, unacceptably high consumer prices. Scenario 3 is the same policy where 1985 is the first stage in the implementation. This allows the

Table 1. Summary of Results of Simulations for 1985 Compared With 1984 and 1985.

ITEM	BASE		SCENARIO			
	1984	1985	1	2	3	4
				(million HL)		
Canadian Requirements[a]	47.41	48.00	45.47	44.86	47.66	43.45
				(million KG)		
Surplus Powder	93.44	96.56	96.92	79.50	94.62	59.13
				(1984 dollars per HL)		
"Target" Support Price	44.30	45.66	45.76	50.81	44.71	45.73
In-quota Levy Rate	4.74	4.96	4.25	4.52	4.91	3.69
				(million 1984 dollars)		
Butterfat Subsidy	285.87	278.83	264.15	0.00	206.60	234.06
Total Losses on Exports	223.92	228.75	188.02	195.66	228.00	159.22
Market Returns	1814.33	1832.36	1740.38	1935.33	1845.93	1680.19
Gross Farm Income	1830.24	1836.40	1770.46	1693.63	1778.49	1740.47
Net Farm Income[b] at $35.00/HL	170.94	173.09	194.75	139.02	127.05	234.78
Net Farm Income[b] at $32.50/HL	289.46	291.89	307.30	250.07	245.01	342.33
Net Farm Income[b] at $30.00/HL	407.98	410.70	419.85	361.11	362.97	407.98
				(percent of 1984)		
Retail Price Index:						
Cheese	100.0	103.6	103.6	110.0	104.3	104.3
Condensed Products	100.0	103.6	103.6	109.2	104.3	104.3
Ice Cream	100.0	103.7	103.7	108.0	104.1	104.1
Butter	100.0	103.3	103.3	114.7	104.7	104.7
Skim Milk Powder	100.0	103.6	103.6	109.4	104.2	104.2
				(millions)		
Aggregate Consumption:						
Cheese in KG	200.99	204.02	204.02	194.93	203.01	203.01
Condensed Products in L	60.00	60.60	60.60	59.70	60.60	60.60
Ice Cream in L	310.00	313.10	310.10	313.00	313.10	313.10
Butter in KG	107.53	108.60	108.60	98.97	107.53	107.53
Skim Milk Powder in KG	45.22	45.22	45.22	44.32	45.22	45.22

[a] Includes milk for the Special Export Program

[b] Average costs of production for standardized industrial milk are subject to some uncertainty so Net Farm Income is calculated with 3 values for these costs - $35.00, $32.50 and $30.00 per HL.

increases in consumer prices to be spread out more evenly but still has a detrimental effect on net farm income. Scenario 4 may be too complex and requires the largest drop in production of all alternatives, which makes this alternative appear unattractive. However, when viewed from its impact on farmers incomes, consumers, and taxpayers, it seems to offer a means by which all three can simultaneously make gains.

Scenario 1 also appears to be an attractive alternative. This policy is neutral with respect to the consumer but would increase net farm income and reduce transfers from taxpayers if adopted. Unfortunately, like Scenarios 2 and 4 a substantial reduction in Canadian Requirements is involved.

OVERVIEW OF THE DAIRY SECTOR

Dairy farmers in Canada produce and ship two types of dairy products, milk and farm separated cream. Cream shippers can be identified as a separate group in that their product is high in butterfat and relatively low in solid non-fat. The skim milk by-product is retained on the farm and used as a livestock feed.

Milk shipped can be divided into shipments of milk for fluid purposes and shipments of milk for industrial purposes. An individual dairy farmer is likely to ship both fluid and industrial milk in the same tanker truck. Because of different pricing arrangements for fluid and industrial milk, he receives a weighted average price for his milk somewhere between the price of fluid milk and industrial milk. Our concern in this paper is with the industrial market so some simplifying assumptions are made about the fluid market in simulations for the period 1985-88. Because of different concentrations of industrial milk producers regionally, regional differences in milk produced and regional price incentives, industrial milk can also be differentiated from fluid milk on the basis of its analysis. The butterfat content and solid non-fat content is different.

In several provinces, there is more than one classification of industrial milk depending upon what the milk is used to produce. Farmers receive different industrial milk prices for industrial milk in different classes. Because of the possibilities for interregional competition within provinces, and interprovincial competition in the wholesale market for processed products it seems unlikely that these farm level price differences are reflected in the price of processed

Table 2. Production of processed dairy products for calendar year 1981

Product	Units (1000's)	Amount	Weight (Kg/unit)
Fluid Market			
Standard Milk	L	9,656	103.0
Low Fat Milk:			
Low Percent Milk	L	13,648	103.0
Skim Milk	L	837	103.4
Chocolate Drink	L	889	103.0
Butter Milk	L	138	103.4
Total Low Fat	L	15,513	-
Creams:			
Cereal Cream	L	651	102.3
Table Cream	L	66	101.4
Whipping Cream	L	167	100.6
Sour Cream	L	111	97.2
Total Creams	L	995	-
Industrial Market			
Ice Creams:[a]			
Hard Ice Cream	L	2,946	-
Soft Ice Cream	L	167	-
Total Ice Cream	L	3,114	-
Condensed Products:			
Condensed Milk	L	118	106.5
Evaporated Milk	L	1,294	129.3
Evaporated Partly Skim Milk	L	11	114.2
Condensed Skim Milk	L	340	99.1
Evaporated Skim Milk	L	319	99.1
Total Condensed Products	L	2,083	-
Yogurt	L	359	103.0
Cottage Cheese	L	39,707	103.0
Whole Milk Cheeses:			
Cheddar Cheese	Kg	98,543	1.0
Variety Cheese	Kg	75,541	1.0
Total Whole Milk Cheeses	Kg	174,084	1.0
Creamery Butter	Kg	113,348	1.0
Skim Milk Powder	Kg	136,688	1.0
Whey Products:			
Whey Powder	Kg	56,926	1.0
Whey Butter	Kg	4,034	1.0
Total Whey Products	Kg	61,030	
Powdered Butter Milk	Kg	4,403	1.0
Other Whole Milk Products	Kg	16,338	1.0
Other Milk By-Products	Kg	1,745	1.0

Source: Statistics Canada, "Dairy Review", Cat. No. 21-Vol., December 1981.
[a] Ice cream is made from ice-cream mix. There were 1,534,870 HL of mix made in 1981 with a weight of about 109.04 Kg

products. Instead, these farm level price differentials must be reflected in differentials in the values of quotas and the incomes the quotas generated.

Milk and cream is processed into literally hundreds of dairy products and by-products after it leaves the farm. These products can be grouped to demonstrate the utilization of milk in Canada as shown in Table 2. Milk sold for fluid purposes is processed into standard milk, low fat milk and creams. Milk sold for industrial purposes is processed into ice cream, condensed products, yogurt, cottage cheese, whole milk cheeses, butter and skim milk powder. Whey is a by-product of cheese manufacturing and some, although not all, whey is utilized in the manufacture of whey powder and whey butter. Buttermilk is a by-product of creamery butter production and is utilized for making buttermilk powder. A significant portion of buttermilk is blended back with skim milk and then used to make skim milk powder. Farm separated cream is utilized for butter manufacture.

Fluid milk is by definition fresh, not subject to storage, so there is no interprovincial trade in fresh milk (except into Newfoundland and the territories) bringing the commodity under provincial jurisdiction. The provinces delegate authority to marketing boards which determine the price of milk and set quotas to prevent overproduction. The constituents of raw milk, butterfat (BF) and protein, lactose and ash, collectively called solid non-fat (SNF), approximates standard milk sold to consumers. The high proportion of milk for fluid purposes processed into low fat products (Table 2) results in a surplus of butterfat which is sold on the industrial milk market as "skim off".

The provincial quotas in effect limit the amounts of solid non-fat that can be sold in the form of fluid milk.

Milk for industrial purposes and farm separated cream, is sold at the farm gate in a market essentially controlled by the Canadian Dairy Commission (CDC). Support prices for butter and skim milk powder at the wholesale level are the primary policy instruments. The CDC purchases any quantities of these commodities that cannot be sold on the domestic market at the support prices. The butter purchased is stored and sold on the domestic market when prices rise above the support levels and excess skim milk powder is exported.

Butter and skim milk powder are essentially joint products of milk in that butter is chiefly made from the butterfat constituent of milk while skim milk powder is manufactured from the SNF constituents of milk. The effect of the support prices then is to determine market returns or the market price of milk that farmers receive and processors pay. This price is effectively the value of butter and skim milk powder which can be made from a HL of milk less processing and marketing costs to the wholesale level. This farm to wholesale margin is essentially negotiated by the CDC in meetings with processors and farm leaders.

The CDC attempts to adjust the support prices of butter and skim milk powder so that farmers receive a target price subject to the constraint that national butterfat production and utilization balance annually at the price of milk implicit in the support price. This results in an over-production of skim milk powder which is sold on the

export market. Farm separated cream is also sold on the industrial market at a price determined by the butter and powder support prices.

Because world prices for skim milk powder are below the Canadian support price, exports are sold at a loss. The money to cover this loss is raised by a levy on the price farmers receive so that farmers pay the cost of disposing of surplus SNF. A "butterfat" subsidy of $1.675 per kg or $6.03 per HL of standard (3.6 kg BF/HL) milk is also paid to farmers. The subsidy was originally introduced to support the incomes of industrial milk and cream producers. The net price farmers receive therefore is market returns plus the butterfat subsidy minus the levy. This price is called the "Net Target Base Price" by the CDC. The CDC also has a term for market returns plus the direct subsidy: the "CDC Target Support Price". The second term is sometimes called "Target Returns" and usually used in discussions of the price of milk but the first term is obviously a better measure.

The net target base price has historically been set at a level above the marginal cost of producing milk for the industry. This would result in overproduction of milk and therefore additional surpluses of skim milk powder and butter which would both have to be sold at a loss. The CDC prevents overproduction of milk therefore by specifying quantities eligible for the butterfat subsidy and subject to holdback levies by means of the Market Sharing Quota (MSQ). The amount of MSQ is established at the national level and allocated to provinces and producers within provinces. Milk production in excess of MSQ by an individual producer is not eligible for the butterfat

subsidy and is subject to a larger levy. The levy on over-quota milk in December 1984, for example, was $34.38 per HL compared to an in-quota levy of $5.75 per HL and a CDC Target Support Price of $44.65. A federal "skim-off" levy on fluid milk of $0.30 per HL was also charged in 1984 to account for the skim-off contribution to surpluses.

Farm separated cream is eligible for the butterfat subsidy but not subject to the in-quota levy. Because it is eligble for the subsidy, it also is part of MSQ on a BF equivalent basis. Cream shippers are able to keep the by-product of cream separation (skim milk) with an opportunity cost determined by the value of the BF and SNF in the skim milk plus the cost of separation on farm. Some cream shippers are constrained by regulation from shipping milk and realizing the benefits of the CDC support price for skim milk powder. The value of the skim milk retained may be lower at its livestock feed value.

MSQ can be measured in terms of BF or in HL of standardized milk. The quota is technically a limit on the amount of BF that can be delivered; the subsidy paid to individuals is based upon the BF content of the milk delivered even though it is most commonly reported as $6.03 per Hl of milk (standardized at 3.6 kg BF per HL). The levies on the other hand are based upon milk itself as adjustments are not made for either the BF or SNF content. The conversion can be done by dividing MSQ in Kg of BF by 3.6 and the result is known as "Domestic Requirements" necessary for butterfat self-sufficiency at the support prices.

Dairy policy is complex but has been structured to satisfy a number of public and private concerns. Prices and farm incomes are stabilized albeit at a level some might consider high. Consumers in general have not complained loudly about dairy pricing and are able to enjoy stability in both prices and supplies. There may be some sentiment, therefore, to not tamper with dairy policy. There is a concern, however, with the cost of the program in terms of government expenditure. The main cost of the dairy program to the federal treasury is the butterfat subsidy. Scenarios 2-4 described above are three approaches to reduce the cost of the subsidy. The evaluation of the impacts of each of these approaches is a major concern of this paper.

The last few years have also seen a modification with a special export program for condensed products. Additional farm level production of milk over and above Domestic Requirements has been established to support the export of condensed and evaporated products. Originally butter imports were allowed to offset butterfat exported so the net effect was an export of SNF. This program has had a number of advantages even though the import of butter is no longer a part of the program: domestic demand for dairy products grows very slowly so the program allowed a more rapid increase in demand and therefore production; a higher value added product was being exported; and the products originally exported (evaporated milk and partly skimmed evaporated milk) were relatively high in the surplus milk constituent. Some of this advantage has evaporated as the product exported under the program more recently has been condensed whole milk. Thus the special export program has ceased to reduce the

relative imbalance of SNF demand and has the disadvantage that export subsidies still have to be paid since the product is sold at less than the Canadian costs of production.

Total planned production of milk in Canada in terms of standard milk is Domestic Requirements plus the additional production made eligible for the subsidy under the special export program. Together these are called Canadian Requirements and measured in HL of standard milk. Canadian Requirements is used in this report as the primary measure of the level of production. The effects of dropping the special export progam component of Canadian Requirements is another concern of this report.

DESCRIPTION OF THE MODEL

Scope of Analysis

The objective of this study is to demonstrate the impact of policy change using quantitative analysis. A programming model is used to depict the utilization of milk and dairy products in Canada. Supplies are taken as fixed for each of the types or classes of milk produced in Canada. The model is to represent mathematically how these supplies are utilized; how much of the various dairy products will be produced and what will be the levels of exports and domestic consumption under a variety of policy options.

The products produced are aggregated into the eight major types consistent with the classifications of products in Agriculture Canada's Food and Agricultural Regional Planning (FARM) Model so that demand characteristics from that model can be incorporated into the programming model. The eight types of dairy products are standard milk, low fat milk (two percent, skim, chocolate milk and buttermilk), creams (cereal, table, whipping and sour), condensed products (condensed and evaporated whole milk, evaporated partly skim milk, and condensed and evaporated skim milk), ice cream (hard and soft), cheese (cheddar cheese and variety cheese but excluding cottage cheese), creamery butter, and skim milk powder.

Other final products (cottage cheese, yogurt, other whole milk products, other products), are incorporated in a fashion necessary for completeness and consistency. By-products (whey and butter milk) are implicitly incorporated in cheese and butter.

A set of flexible and point demand functions are built into

the LP model. The demand functions and how they are incorporated in the LP is described in the following sub-section. A description of the supply component of the model follows. The supply side is quite simple because farm gate production is fixed but there are differences in the supply side between the base version of the model for 1984 and subsequent years. The linkage between supply and demand is described in the third sub-section of this chapter. This includes a discussion of the composition of the various dairy products and how the processing transformations link supply and demand. The procedures used to estimate unit processing costs are then described. The final sub-section of this chapter describes how the analysis of the impacts of the various policy options on farm incomes, government expenditures is done through a number of identities.

Demand Component

Flexible demands are incorporated using the Duloy-Norton technique. This technique has the advantage of allowing the incorporation of demands into a linear model without restricting the shape of the demand functions[1]. The demand functions incorporated are based upon demands from the FARM Model. Demands are estimated in the FARM model for standard milk, lowfat milk, creams, ice cream, condensed products, cheese, skim milk powder, and butter. All of these demands

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[1] Functional forms with an infinite area under the demand curve such as $Q = AP^B$ do create problems.

except those for creams are incorporated endogenously into the model run for 1984. Creams are not incorporated because data on market prices of cream as opposed price indices for cream are not available. The model for years 1985-1988 includes just the industrial milk products as endogenous demands. Point or exogenous demands are used for yogurt, cottage cheese, other dairy products and creams for all years.

Demand constraints are included in the model for each of the major aggregations of exogenous dairy products. Each demand constraint for the products with point demand looks very much like a line out of a supply and disposition table:

(1) A_{1j} BEGINV - A_{2j} ENDINV + A_{3j} NETIMP + $PROD_j$ = DMD_j

for j = 1 for cream,
= 2 for cottage cheese,
= 3 for yogurt,
= 4 for other skim milk products, and
= 5 for whole milk products;

where BEGINV is beginning inventories fixed at a value of 1.0,

ENDINV is ending inventories fixed at a value of 1.0,

NETIMP is net imports (imports less exports) fixed at a value of 1.0,

$PROD_j$ is the amount produced for each j, and

DMD_j is domestic disappearance or demand for each j.

A modified version of Equation (1) is required for commodities with flexible demands.

The FARM demand equations are specified on a quarterly basis in per capita terms and include numerous dummy variables for season,

etc. A number of modifications are necessary to utilize the FARM Model demand functions. The farm model is run to obtain the baseline of projections for prices and aggregate quantities for the entire year shown in Table 3. The demand elasticities shown in Table 3 are then used to construct demand functions that would pass through the price quantity coordinates incorporating parameters implicit in the elasticities.

The demand equations are solved for 1984, with demand at 90 percent of the level of 1984, and at interval increments of one half of one percent of 1984 to a maximum demand level of 110 percent of 1984 demand to produce a set of coefficients for use in the model. The values for quantity demanded, and area under the demand curve presented in the Appendix are incorporated in the model as coefficients.

Equation 2 is a form of the constraint for the endogenous commodities.

$$(2) \qquad A_{1j}\ \text{BEGINV} - A_{2j}\ \text{ENDINV} + A_{3j}\ \text{NETIMP} + \text{PROD}_j - \sum_{i=4}^{44} A_{ij}\text{DMD}_{ij} \leq 0$$

Where A_{ij} is the amount of commodity j demanded of at demand level i as shown in the Appendix. For each commodity a control constraint is added so that multiples of demand of each commodity cannot be selected:

$$(3) \qquad \sum_{i=4}^{44} \text{DMD}_{ij} = 1.0$$

Table 3: Characterization of demand equations

Commodity	Projected 1984		Elasticity		
	Price[a] Index	Quantity	Price	Income	Timetrend
Standard Milk	123.3	848 ml	-0.34	0.07	-0.74
Lowfat Milk	123.3	1738 ml	-0.33	0.58	0.00
Ice Cream	118.5	310 ml	-0.18	0.38	0.00
Condensed Products	128.8	60 ml	-0.39	0.13	0.00
Cheese	132.6	202 mkg	-0.73	1.06	0.00
Butter	125.8	107 mkg	-0.80	0.22	0.00
Skim Milk Powder	125.7	45 mkg	-0.39	0.00	0.00

[a] Price index with 1981 equal to 100.

The demand equations for 1985, 1986, 1987 and 1988 are the 1984 equations shifted outwards for the effects of population growth, growth in per capita income and changes in the trend variable. Projected per capita income and population are shown in Table 4. Inflation is incorporated in the cost as described below and therefore prices are appropriately modified.

Table 4. Projections of population and per capita incomes

Year	Population (millions)	Per Capital Income ($)	Inflation Rate (%)
1984	25.1540	11398.9	-
1985	25.3806	11837.2	3.8
1986	25.6106	12231.1	3.5
1987	25.8341	12720.8	3.6
1988	26.0400	13161.3	4.3

Source: Population projections are from Statistics Canada while per capita income and the inflation rate are from the Conference Board's Canadian Forecast.

Equation 2 is further modified in the case of butter and skim milk powder and condensed products. The 'NETIMP' variable is replaced with a variable 'BUTEXP' and 'PDREXP' with a coefficient of 1.0. The parameters for Equations are given in Table 5. For all simulations in this study, beginning and ending inventories are the same so that surplus product will all show up as surplus butter and powder for export. Condensed export are treated as a separate commodity and exports are fixed at 81 ml.

Table 5. Parameters for the demand constraint rows for calendar 1981.

Product	Units	Beginning Inventories	Ending Inventories	Net Imports
Standard Milk	ml	0	0	0
Low Fat Milk	ml	0	0	0
Creams	ml	0	0	0
Ice Cream	ml	0	0	0
Cheese	mkg	48,280	48,280	15,838
Butter	mkg	36,050	36,055	NA
Skim Milk Powder	mkg	39,551	39,551	NA
Cottage Cheese	ml	0	0	0
Yogurt	ml	0	0	0
Other Skim	mkg	0	0	0
Other Whole	mkg	0	0	0

Supply Component

The restraints on total milk available by type are given in Equations 4.

(4) $FLDTRF \leq FLDPROD$

$CRMTRF \leq CRMPROD$

$BIMTRF + CRMTRF + OQMTRF \leq INDPROD$

Where FLDPROD is the amount of milk produced for the fluid market in million litres,

CRMPROD is the amount of milk equivalent farm separated cream produced in million litres, and

INDPROD is the amount of industrial milk produced in million litres.

The *** TRF variables identify the amount of milk produced according to its category for pricing: FLD for fluid milk, CRM for farm separated

cream, BIM for industrial milk and OQM for over quota milk. FLDPROD is assumed to be 26.11 mHL in 1984 and dropped from versions for 1985-88. CRMPRD is assumed to decline from 1984 to 1988 as follows: 1.82, 1.69, 1.57, 1.46 and 1.36 mHL in whole milk equivalent units on a BF basis.

To differentiate between industrial milk and over quota industrial milk it is necessary to specify another constraint for the MSQ quota. The MSQ constraint on production is framed as a constraint on butterfat production:

(5) $$3.62508\ \text{BIMTRF} + 3.6\ \text{CRMTRF} \leq \text{MSQQTA}$$

where MSQQTA is the MSQ quota in million kilograms of butterfat. The CRMTRF variable is included in this equation because farm separated cream is counted as part of the quota. The coefficient 3.6 is because farm separated cream is measured in equivalent HL of standard milk. The coefficient for BIMTRF was found by dividing total butterfat deliveries of industrial milk by total milk deliveries for 1981.

From the policy maker's point of view the penalties are established at sufficiently high a level such that over quota production will not take place. Consequently, all over quota production is supressed. The level established for MSQ then should be at the exact point where the MSQ constraint is effective for the specified support prices. To achieve this result MSQ is set slightly above the anticipated level of Canadian Requirements so that small surpluses of butter for export are generated. An ex post adjustment of the model solution is then done so that butterfat supplies and demands exactly balance and no butter is available for export. The adjustment is to reduce

industrial milk production by 0.23005 HL for every kg of surplus butter available for export and make the corresponding adjustment to MSQ. This, of course, also reduces the amount of solid non-fat available for manufacturing into powder for export so powder exports are also reduced by 1.933 kg for every kg of surplus butter.

These ratios are derived as follows: Milk in excess of Canadian Requirements is used to produce butter and skim milk powder for export in the proportions indicated by the solution of Equations 6.[2]

(6) $$.8198\ BUTEXP + .0074\ PDREXP = 3.62568\ MLK$$

$$.1264\ BUTEXP + .965\ PDREXP = 8.6585\ MLK$$

where MLK is the amount of milk in excess of Canadian Requirements. The parameters in the first equation is the amount of BF in Kg per Kg of butter, per Kg of skim milk powder, and per HL of milk, while the parameters in the second equation is the amount of SNF in Kg per unit.[2] Since equations 6 are two equations in three variables any one variable can be specified and the other two determined. Thus if BUTEXP equals -1.0 and Equations 6 are solved then PDREXP are -1.933 kg and MLK is reduced by .23005 HL. This means that the appropriate level of MSQ and industrial milk production is derived from the level of exports of butter for an arbitrary level of MSQ QTA (Equation 5). Canadian Requirements, CR, becomes a model result rather than a model parameter to be prespecified:

(7) $$CR = MSQQTA/3.6 - MLK * 3.62568/3.6.$$

This measure of production is the sum of Domestic Requirements plus production for the special export program.

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[2] The derivation of the parameters in Equation 6 is described below.

The behaviour of the fluid market for 1984 is fairly easy to project because most of the information is now available on prices, demand determinants and provincial policies. However, the quantities demanded over the period 1985-88 is more difficult to project because it depends in part on policies that may be adopted by the various provincial governments. A simplifying assumption is therefore made for the behaviour of the fluid market: the amount of skim-off BF will be unchanged from that of 1984. The fluid market components of the model for these years is therefore dropped from the model and replaced with a variable which supplies skim-off butterfat. The variable is fixed at the 1984 level.

Balance Equations

The core of the model is a set of linkage or "balance equations" for BF and SNF. The balance equations constrain production in that the total BF and SNF used in the manufacture of dairy products is less than or equal to the BF and SNF delivered by farmers in the form of fluid milk, industrial milk and farm separated cream. Because the fluid market is separated from the industrial market by regulation a separate pair of balance equations is included for each market. Variables are also included to transfer BF and SNF from the fluid market to the industrial market but not in reverse.

The butterfat and solid non-fat balance equations for the fluid market are:

(8a) $$- 3.70\ \text{FLDTRF} + 3.6\ \text{FATTRF} + .03604\ \text{STDPRD} + .0195647\ \text{LFTPRD} + .157195\ \text{CRMPRD} \leq 0$$, and

(8b) - 8.72 FLDTRF + .085 STDPRD + .087 LFTPRD +. .051 CRMPRD < 0

Where:

STDPRD is the amount of standard milk produced in million litres,

LFTPRD is the amount of low fat milk produced in million litres,

CRMPRD is the amount of creams produced in million litres, and

FATTRF is the amount of butterfat transferred from the fluid to the industrial market in fat equivalent HL.

The butterfat parameter for fluid milk is found by dividing the total amount of butterfat delivered for fluid purposes in calendar 1982[3] by the amount of fluid milk shipped, 26,087,150 HL (Dairy Market Review). An overall average of 8.72 kg of solid non-fat per HL is assumed for Canada.

Other parameters in Equation 8 reflect utilization BF and SNP in the manufacture of dairy products. Data for the composition of dairy products produced from milk sold for fluid purposes is given in Table 6. These are multiplied by the amounts produced in 1981 from Table 2 and aggregated to give the total butterfat and solid non-fat utilized by Standard Milk and the two aggregate commodities low fat milk and creams. These are then divided by the quantities of aggregate commodities produced. This procedure results in a surplus of 15 mKg of

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[3] According to Canadian Dairy Commission, this was 96,622,630 kg.

BF and a deficit of 10.6 mKg of SNF for the 1981 calendar year. The BF surplus accords well with notions of the amount of skimoff BF moving from the fluid market to the industrial market. The deficit of SNF amounts to 4.7 percent of total SNF produced. Canadian cows tend to produce less SNF relative to BF than American cows yielding 3.7 kg BF/HL (USDA, ARS). Consequently, it is assumed that Canadian Dairy Products tend to have lower amounts of SNF. The 4.7 percent deficit in SNF is therefore reduced to zero by adjusting the coefficients for standard milk and fluid milk proportionately. The result then is the coefficients given in Equation 8.

Table 6. Composition of dairy products produced from milk for fluid purposes.

Product	Weight (Kg.HL)	Butterfat[a] (Kg.HL)	Solid Non-Fat (Kg./HL)
Standard Milk	102.97	3.6040	8.935
Two Percent Milk	102.97	2.0594	9.151
Skim Milk	103.4	0.1034	9.344
Choc. Milk	102.97	2.0594	8.821
Butter Milk	103.4	0.9116	9.313
Cereal Cream	102.28	10.28	6.4778
Table Cream	101.44	15.50	5.0889
Whipping Cream	100.59	35.21	4.9940
Sour Cream	97.21	18.50	6.5221

Source: The BF parameters are determined by multiplying the weights of the product by minimum regulated butterfat requirements: 3.5, 2.0, 10, 15 and 35 percent respectively for standard milk, two-percent milk, cereal cream, table cream, and whipping cream. Other BF values and SNF values are from composition of foods. Dairy and Egg Products, Raw. Processed, Prepared, USDA, ARS, Agricultural Handbook No. 8-1. Washington, Nov., 1976.

The butterfat and solid non-fat equations balance equations respectively for the industrial market are:

(9a) $- 3.6\ CRMTRF - 3.62568\ BIMTRF - 3.62508\ SIMTRF$
$- 3.62508\ OQM - 3.6\ FATTRF + .0597117\ ICEPRD$
$+ .0689165\ CNDPRD + 0.32990\ CHSPRD + 0.8198\ BUTPRD$
$+ 0.0074\ PDRPRD + .0783\ COTPRD + .036\ YOGPRD$
$+ .152\ OTWPRD + .0074\ OTHPRD \leq 0$, and

(9b) $- 0.669\ CRMTRF - 8.49\ BIMTRF - 8.49\ SIMTRF$
$- 8.49\ OQMTRF - SNFTRF + .0570224\ ICEPRD$
$+ .225351\ CNDPRD + 0.87135\ CHSPRD + 0.1264\ BUTPRD$
$+ 0.965\ PDRPRD + .5945\ COTPRD + .087\ YOGPRD + 0.397\ OTWPRD$
$+ .965\ OTHPRD \leq 0$,

Where: ICEPRD is the amount of ice cream produced in mHL,

CNDPRD is the amount of condensed and evaporated milk produced in mHL,

CHSPRD is the amount of cheese produced in mKg,

BUTPRD is the amount of butter produced in mKg,

PDRPRD is the amount of skim milk powder produced in mKg,

COTPRD is the amount of Cottage Cheese produced in mKg.

YOGPRD is the amount of Yogurt produced in million litres,

OTWPRD is the amount of other white milk products produced in mKg,

OTHSNF is the amount of other skim milk products produced in mKg, and other variables are as defined above.

Equations 8 ensure that the total utilization of BF and SNF measured in Kg is not greater than the available supply of BF and SNF on the industrial market.

The parameters are estimated in a manner similar to the estimation of parameters for the fluid market. The average butterfat content of industrial milk, 3.62508 kg/HL, is determined again by dividing total butterfat deliveries in milk for industrial purposes by total industrial shipments of 45,299,180.[4] The BF coefficient for the CRMTRF variable is the amount of butterfat in a HL of standard milk. The SNF coefficient for farm separated cream is calculated by assuming the BF:SNF ratio in farm separated cream is 50:4.

The coefficients for the products made from industrial milk are also calculated in a manner analagous to the method used for the fluid milk products. Some differences in methodology are required because of the production of by-products: buttermilk in the production of butter and whey in the manufacturer of cheese. In these instances coefficients are based upon the quantities of milk required to manufacture a unit of product rather than analysis of the product.

The BF and SNF content of ice cream mix and the condensed products are given in Table 7. These values are multiplied by the amount of production of ice cream mix and of the various condensed products in Table 2 to estimate the total BF and SNF utilized in the manufacture of ice cream mix and BF and SNF utilized for condensed

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[4] According to the Canadian Dairy Commission this was 164,213,150 kg.

Table 7. Composition of ice cream mix and condensed dairy products

Product	Weight (Kg/HL)	Butterfat (Kg/HL)	Solid Non-fat (Kg/HL)
Ice Cream Mix	109.04	11.99	11.45
Condensed Milk	106.51	9.266	21.30
Evaporated Milk	129.33	9.777	23.80
Evaporated Partly Skim Milk	114.21	5.368	26.27
Condensed Skim Milk	99.08	.1982	20.21
Evapoated Skim Milk	99.08	.1982	20.21

Sources: Values for ice cream mix taken from Lincoln M. Lamport, Modern Dairy Products. Chemical Publishing Co. Inc., New York. 1970. Other Values taken from USDA, ARS, "Composition of Food Products", Agricultural Handbook No. 8-1, Wash., D.C. 1976.

products. Ice cream both soft and hard is made from ice cream mix so the average composition of ice cream is found by dividing the BF and SNF totals for ice cream mix by the total amount of ice cream produced in calendar 1981. Similarly, the average composition of a condensed product is found by dividing the BF and SNF totals by the total amount of condensed products made in 1981.

Butter is made from milk which has first been separated into skim milk and cream. Skim milk powder is made from the skim milk and butter from the cream. The BF content of skim milk powder is 0.0074 Kg per Kg (USDA, ARS) and the SNF content is assumed to be 0.965 Kg

per Kg. The BF content of butter is 0.81 kg per kg while the SNF content is 0.01 kg per kg. According to Stonehouse 8.232 kg of skim milk powder and 4.3218 kg of butter is made from a HL of milk. The difference then between the BF and SNF incorporated in 4.321 kg of butter plus 8.232 kg of skim milk powder and in a HL of milk is the BF and SNF in the buttermilk by-product. The BF (.0098 kg) and SNF (.1164 kg) in the by-product is incorporated in the coefficients for BUTPROD in Equations 9.

According to the CDC eleven kg of milk are required to manufacture one kg of cheddar cheese. These implies 0.3734 kg of BF and 0.8806 kg SNF is required to manufacture a kilogram of cheese including the BF and SNF in the cheese, whey and losses. It is not possible to perform a similar calculation for variety cheese because of lack of data. The parameters for variety cheese are estimated from residuals after subtracting from BF and SNF production utilization in all products as described above plus cottage cheese, yogurt, other whole milk products and other skim milk products. It is necessary to make some broad assumptions to make estimates of BF and SNF utilized by cottage cheese, yogurt and other products but the residuals suggest coefficients for variety cheese which are in close agreement with those for cheddar cheese and a number of specific variety cheese.

It is assumed that one kg of cottage cheese is made from seven kg of skim milk (Canadian Diary Commission) and that fifty percent of cottage cheese is sold in the form of creamed cottage cheese. Creamed cottage cheese is a mixture of cream and cottage

cheese so that the analysis of the product is identical with the analysis of creamed cottage cheese as reported by USDA, ARS with an appropriate adjustment for yield. The BF and SNF required to make a HL of cottage cheese including losses and whey is thus estimated to be 0.0283 kg and 0.5945 kg, respectively.

Some broader assumptions are made to account for the remaining products. It is assumed that yogurt has roughly the same analysis as whole milk: 3.6 kg BF per HL and 8.7 kg SNF per HL. It is assumed that other skim milk products has the same analysis as skim milk powder. It is assumed that other whole milk products is 50 percent malted milk and 50 percent whole milk powder implying an analysis of 0.152 kg BF and 0.397 kg SNF per kg. The difference then between production of BF and SNF and utilization in all products except variety cheese is 20635.121 tons BF and 64911.972 tonnes for SNF. This implies coefficients for variety cheese of 0.27316 kg BF and 0.85929 kg SNF per kg of product. When combined with the coefficients for cheddar cheese (0.3734 kg BF and 0.8806 kg SNF per kg) the result is average cheese coefficients of 0.3299 kg BF and 0.87135 kg SNF per kg cheese which are incorporated into Equation 9.

Processing Costs

Farm gate to wholesale margins for butter and skim milk powder are established by a negotiation process between the CDC and farm and manufacturing representatives. Application of the federal 6 & 5 price restraint program resulted in the concensus processing costs for 1984 of 5.53 $/HL of standard milk. These costs are assumed to increase as

shown in Table 8 for 1985-88. To calculate unit processing costs for butter and skim milk powder we make the additional assumption that processing costs are in a 30:70 ratio. This ratio together with the analysis of standard milk and the butter and skim milk powder coefficients in Equations 8 allows the calculation of the unit processing costs for butter and skim milk powder also given in Table 8. Wholesale-retail margins for butter and skim milk powder can be found by subtracting average retail prices from the support prices. The sum of the processing costs and the wholesale- retail margin is the farm-retail margin shown in Table 9.

If unit processing costs are subtracted from the support prices for butter and skim milk powder the result is net farm returns per unit of butter and skim milk powder. The net farm returns can then be used in the objective function of an LP which maximizes the

Table 8. Processors margin and unit processing cost (farm-wholesale margins) for butter and skim milk powder.

Year	Processor's Margin	Unit Processing Costs	
		butter	SMP
	(dollars/HL)	(dollars/Kg)	
1984	5.53	0.2171	0.5067
1985	5.72	0.2238	0.5223
1986	5.95	0.2336	0.5452
1987	6.19	0.2431	0.5671
1988	6.44	0.2529	0.5901

Table 9. Wholesale-retail and Farm-retail Margins by Commodity and Year.

Price Spread and Year	Commodity				
	Butter	SMP	Cheese	Condensed	Ice Cream
	------(dollars/Kg)------			-(dollars/litre)-	
Wholesale-Retail					
1984	.6912	2.5388	-	-	-
1985	.7175	2.6353	-	-	-
1986	.7426	2.7275	-	-	-
1987	.7693	2.8257	-	-	-
1988	.8024	2.9472	-	-	-
Farm-Retail					
1984	0.9083	3.0455	4.1855	1.3440	0.9595
1985	0.9413	3.1576	4.3445	1.3951	0.9560
1986	0.9762	3.2727	4.4966	1.4439	0.9895
1987	1.0124	3.3928	4.6585	1.4959	1.0251
1988	1.0553	3.5373	4.8588	1.5602	1.0692

value of butter and skim milk powder produced from a HL of standard milk. The LP is illustrated in Figure 1. The solution of the LP also includes the shadow prices of butterfat and solid non-fat. Since the manufacture of butter and skim milk powder is always a possibility because of the support price policy, these shadow prices are also applicable to all other industrial products. The net farm value of each of these products is calculated by multiplying the butterfat and solid non-fat coefficients for the product from Equation 8 by the appropriate shadow prices. Subtracting the net farm value from retail price gives the farm retail spread presented in Table 9 for the rest of the commodities.

	Butter	SMP	Restraint
Objective	4.5414	2.3233	
Butterfat	.8198	.0074	$\leq$ 3.6
Solid non-fat	.1264	.9650	$\leq$ 8.6

Figure 1. LP tableau to calculate shadow prices of butterfat and solid non-fat.

The procedure outlined above can be used for any pair of support prices for butter and skim milk powder where the ratio of the net farm value of butter and to net farm value of skim milk powder lies in the range between 0.1:1 to 110.8:1. Another way of illustrating this range is to note that with a farm value of $2.32 per kg for skim milk powder, the farm value of butter would have to rise above $250/kg or fall below $0.23/kg before the procedure is invalidated. Furthermore, the range is independent of the ratio in which BF and SNF are available. This wide range is due to the dominance of butterfat in the manufacture of butter and solid non-fat in the manufacture of skim milk powder. The 1984 support prices imply a price ratio of 2.0:1 which of course is well within the range.

To project these results past 1984 some further assumptions are needed. It is assumed that the retail-wholesale margins grow at the assumed inflation rate (see Table 4) for butter and skim milk

powder. It is also assumed that the entire retail-farm margins grow at the inflation rate for the other commodities. The projected margins for the 1985-88 are also given in Table 9.

Objective Function

The objective function maximizes the sum of the areas under the demand curves minus processing costs. The areas under the demand are given in the Appendix for 1984. Because supplies tend to exceed demand for milk at the farm level in the absence of the MSQ quota, changes in the farm price are totally reflected in quota values rather than the quantity of milk supplied. Therefore the cost of producing the milk can be taken as given. The solution therefore gives an optimal (and a market) allocation of this milk among alternative uses given the support price policy.

Farm Income and Government Expenditures

Government intervention in the commodity market is involved with establishing support prices and effectively isolating the Canadian consumer from the international market. Domestic consumption of the various dairy products therefore is completely determined without reference to such factors as the butterfat subsidy and levy rates. Both of these affect the farm price but do not affect the consumer price. If the support prices continue to be set at levels that would generate excess supply in Canada, then the MSQ quota is effective and the amounts of butter and skim milk powder to be disposed of is also determined without references to levies and the butterfat subsidy. Farm income and

the cost of government intervention, therefore, can be determined within the model by a set of accounting equations or from an ex post analysis of the model solution. It is the latter approach that is used here.

There are two costs associated with the program that are attributable to government: the butterfat subsidy and the losses on disposition of surplus powder and butter. The butterfat subsidy can be calculated by:

(10) BFSUB = 6.03 (BIMTRF*3.6/3.62508 + CRMTRF)

The ratio 3.6/3.62508 is included to adjust industrial milk back to standard milk for which the $6.03/HL subsidy is applicable. It is assumed that levies are adjusted to cover losses associated with the industrial milk policy except for the butterfat subsidy. Government expenditures then are just the value of the subsidy given by Equation 10.

It is assumed that net revenues from disposition of surplus powder and butter are to be $1.00 and $1.40/Kg respectively in 1984. Losses per unit disposed therefore are the support prices minus these net revenues for 1984-88 as shown in Table 10. These losses increase in nominal terms at the inflation rates in Table 4. Total losses can then be calculated by:

(11) TL = UBL · BUTEXP + UPL · PDREXP + UCL · CNDEXP

where UBL, UPL, and UCL are the unit losses on exports of butter, powder and condensed products respectively.

Government receives levies to offset export losses calculated by:

(12) LEVIES = FL · FLDTRF + BL · BIMTRF + OQL · OQMTRF

where FL, BL and OQL are the levy rates for fluid milk, industrial milk and over-quota milk. These rates are $0.30 and $34.38 per HL for fluid milk and over-quota respectively. The assumption is made throughout that there is no production of overquota milk and that 26.11 mHL of fluid milk are produced. Hence the levy rate for industrial milk which just covers export losses, is a model result found by equating equations 10 and 11 and solving for BL.

This procedure implies that levies are raised only to subsidize current exports of skim milk powder and evaporated milk. Levies are also used to cover a number of other costs associated with the support program: these other costs include deficits (or surpluses) carried forward from previous years, advertising and promotional expenses, carrying charges on butter which is temporarily surplus, etc. The levy to support the export of skim milk powder and evaporated products we estimate to be about $4.74/HL for 1984 compared to an actual in quota levy of $5.75/HL. The difference to support these other aspects of dairy policy amounts to $47.04 million in total for 1984. This number is subtracted from Gross Farm Income below. It is assumed that this cost will stay at the same level in constant dollars for 1985-88 and is subtracted from gross farm income for these years. The levy rate reported then is the contribution of the exports of skim milk powder and evaporated products to the total levy.

Farmers of course pay the levies and receive the butterfat subsidy so these components of their income are determined by Equations 10 and 11 above. The market returns per HL can be determined by multiplying the shadow prices of butterfat and solid non-fat times the

constituents of the product delivered to processors:

(13) $$MR_i = PBF_m.BF_i + PSNF_m.SNF_i$$

where PBF_m and $PSNF_m$ are the prices of butterfat and solid non-fat in the fluid (m = 1) and industrial (m = 2) markets respectively, and BF_i and SNF_i are the quantities in the products delivered and i = 1,2,3,4 for FLDTRF, BIMTRF, CRMTRF and OQMTRF. The products of course are fluid milk, farm separated cream, in-quota industrial milk and over-quota milk for i = 1 to 4. The variables BF_i and SNF_i are the coefficients in Equations 8 and 9. Total market returns are found by multiplying MR_i by the quantities of product delivered. Thus, total gross farm income, GFI, from all milk sales is determined as:

(14) $$GFI = MR_1.FLDTRF + MR_2.BIMTRF + MR_3.CRMTRF + MR_4.OQMTRF + BFSUB - TL - 47.04.$$

Farm income in the results section is reported for industrial products only so the term $MR_1.FLDTRF$ is dropped from Equation 14.

Table 10. Unit Losses on the Export of Butter and Skim Milk Powder

Year	Butter	SMP	Condensed Products
units	dollars per kg	dollars per kg	dollars per litre
1984	3.359	1.950	0.515
1985	3.535	2.047	0.541
1986	3.799	2.185	0.580
1987	4.079	2.331	0.622
1988	4.363	2.478	0.664

Gross farm income from industrial milk sales differs from Net Farm Income, NFI, by the amount the resources used in producing the milk could earn elsewhere: the feed, land, energy, labour, capital, management skills, etc. What these are per HL of milk is not known, but in aggregate, they must be less than the net target base price in 1984 or the MSQ quotas would not be met. Since costs of production are not known, four values for these costs in 1984 are used to estimate net farm income: $30.00, $32.50, $35.00, and $37.50 per HL. Four different values for net farm income can then be calculated:

(15) $$NFI_s = GFI - C_s \cdot CR$$

for s = 1,2,3,4 where CR is the quantity of milk produced in standardized units (Domestic Requirements plus the special export requirements) from Equation 7. The value for costs of production, C_s, is assumed to increase with inflation for 1985-88 but be reduced by technical change at a rate of 1 percent per year for 1985-88 as discussed below. The value for NFI_s is a primary measure of policy impact on farmers although other important variables, CR, GFI etc., are also reported.

RESULTS OF SIMULATIONS

Base Scenario

For the base scenario the only policy variable predetermined is the set of support prices given in Table 11. All other policy instruments are determined by model parameters and exogenous variables such as population and per capita incomes. Actual support prices of course cannot be known because they are subject to review on a quarterly basis. The support prices given in Table 18 represent a reasonable projection of support prices assuming no major changes in policy. These prices are assumed to grow at slightly less than the inflation rate for most of the period but by 1988, the butter support price has increased at a slightly higher rate than inflation and the skim milk powder support price.

Table 11. Policy variables for the base scenario

Item	Year				
	1984	1985	1986	1987	1988
	(dollars per kg)				
Support Price in Current Dollars:					
Butter	4.759	4.914	5.085	5.290	5.531
Skim Milk Powder	2.830	2.927	2.996	3.088	3.203
Support Price in Constant 1984 Dollars:					
Butter	4.759	4.734	4.733	4.753	4.765
Skim Milk Powder	2.830	2.820	2.789	2.774	2.759
	(percent)				
Price Indices in Current Dollars:					
Butter	100.0	103.3	106.9	111.2	116.2
Skim Milk Powder	100.0	103.4	105.9	109.1	113.2
Price Indices in Constant Dollars:					
Butter	100.0	99.5	99.5	99.9	100.1
Skim Milk Powder	100.0	99.6	98.6	98.0	97.5

The base scenario projection of a set of policy target variables is given in Table 12. The set includes two quantity variables that would be monitored for policy purposes: Canadian Requirements and surplus skim milk powder. Of course, surplus butter would also be of concern, but we assume that butter supplies are exactly met by adjustments in Canadian Requirements as described previously. Canadian Requirements are a measure of the total amount of milk produced and are therefore a direct concern. The magnitude of the surplus powder variable indicates the amount that will have to be disposed at a loss on external markets and this is also an index of the deadweight cost of the program to the Canadian economy in general, and dairy farmers in particular.

Two price variables are also given in Table 12: the CDC "Target" Support Price and the in-quota levy rate. The quotation marks are used to indicate that the variable here is calculated from projected market returns plus the subsidy rather than the planned value that would result from making the calculation that is done in specifying policy instruments by the CDC. The in-quota levy rate is also an actual value for the levy rate which would just enable export losses to be covered. The actual price which farmers receive would be the "Target" Support Price less the in-quota levy.

Finally, the total amount of the butterfat subsidy is also given in Table 12 as this represents the cost of the dairy program to the taxpayer. All variables are given in both absolute amount and in terms of an index with 1984 as a base. Of course, policy makers are

Table 12. Policy Target Variable Projections from the Base Scenario

ITEMS	UNITS	1984	1985	1986	1987	1988
Target Variable (in current dollars):						
Canadian Requirements	mHL	47.41	48.00	48.61	48.87	49.36
Surplus Powder	mKG	93.44	96.56	98.86	98.72	100.83
"Target" Support Price	$/HL	44.30	45.66	46.38	47.83	49.57
In-Quota Levy Rate[a]	$/HL	4.74	4.96	5.08	5.19	5.42
Butterfat Subsidy	m$	285.87	289.43	293.12	294.67	297.63
Percent of 1984:						
Canadian Requirements	%	100.0	101.2	102.5	103.1	104.1
Surplus Powder	%	100.0	103.3	105.8	105.6	107.9
"Target" Support Price	%	100.0	103.1	104.7	108.0	111.9
In-Quota Levy Rate[a]	%	100.0	104.6	107.3	109.6	114.2
Butterfat Subsidy	%	100.0	101.2	102.5	103.1	104.1

[a] Contribution for the export of skim milk powder and evaporated products only.

also interested in the impacts of policy on farm income and the consumer, which are discussed below.

Canadian Requirements grow by slightly more than one percent per year throughout the period 1984-88 because of population growth, per capita income growth, and stable real prices. Current prices (Table 13) increase at a rate slightly below the inflation rate so prices in constant dollars actually decrease slightly following the pattern of the support prices established in Table 11.

A policy concern, however, has to be the fact that the amount of surplus skim milk powder increases throughout the period (Table 12 again). It is to be expected that a growth in demand would cause an

Table 13. Retail Prices from the Base Scenario

Commodity	units	1984	1985	1986	1987	1988
Consumer Prices in Current Dollars:						
Cheese	$/kg	7.96	8.24	8.46	8.76	9.12
Condensed Products	$/L	2.20	2.28	2.34	2.42	2.52
Ice Cream	$/L	1.40	1.45	1.50	1.55	1.62
Butter	$/kg	5.45	5.63	5.83	6.06	6.33
Skim Milk Powder	$/kg	5.37	5.56	5.72	5.91	6.15
Index in Current Dollars:						
Cheese	%	100.0	103.6	106.3	110.0	114.6
Condensed Products	%	100.0	103.6	106.4	110.0	114.7
Ice Cream	%	100.0	103.7	106.9	110.8	115.6
Butter	%	100.0	103.3	106.9	111.2	116.2
Skim Milk Powder	%	100.0	103.6	106.6	110.1	114.6
Index in Constant 1984 Dollars:						
Cheese	%	100.0	99.8	99.0	98.9	98.7
Condensed Products	%	100.0	99.8	99.1	98.9	98.8
Ice Cream	%	100.0	99.9	99.5	99.5	99.5
Butter	%	100.0	99.5	99.6	99.9	100.1
Skim Milk Powder	%	100.0	99.8	99.3	99.0	98.7

increase in the amount of surplus if the increase in demand is for a mix of products that has a higher BF:SNF ratio than the ratio in the additional milk produced. If the increase in demand is for the same mix of products as the original demand then the amount of surplus powder should grow at the same rate as the growth in Canadian Requirements (assuming also no change in ratio in the milk produced). The result that surplus powder is growing more rapidly than Canadian Requirements is an indication that the additional demand is for high BF products. Another factor, however, is the downward trend assumed for farm separated cream causing the ratio of BF:SNF to decline from the supply side. The rise in the amount of skim milk powder for export causes a rise in the in-quota levy rate required to dispose of it. This, of course, will have an adverse effect on farm incomes as described below.

The target support price increases in current dollars but at a rate slightly below the rate of inflation causing a slight decline of 3.6% in constant dollars over the four year period. Support prices are approximately constant in real terms so this decline is caused by the decline in the real value of the butterfat subsidy. The total butterfat subsidy is increasing in current dollars because of the increase in Canadian Requirements, but the subsidy per HL is decreasing in real terms at the rate of inflation. The net result from the taxpayers point of view is a net decline in the real value subsidy of about 10% over the four year period largely translated into the decrease in "Target" Support Price measured in real dollars.

The result of the policy for the consumer is stability of prices as noted above in a reference to Table 13. Because the relative support prices of butter and powder are both increased at a rate very close to the rate of inflation, there is little impact on the mix of products demanded as shown in Table 14. Demand for cheese grows at a slightly higher rate than the demand for other products, especially butter. Butter prices increase by a small amount in relative terms depressing this demand slightly in per capita terms. The relative increase for cheese is caused by the higher income elasticities specified for those commodities as shown above in Table 3.

Table 14. Domestic Consumption from the Base Scenario

Commodity	units	1984	1985	1986	1987	1988
Aggregate Consumption:						
Cheese	$/kg	200.99	204.02	207.05	209.07	211.09
Condensed Products	$/L	60.00	60.60	61.50	61.80	62.70
Ice Cream	$/L	310.00	313.10	316.20	319.30	320.85
Butter	$/kg	107.53	108.60	109.67	109.67	110.74
Skim Milk Powder	$/kg	45.22	45.22	45.67	46.57	47.02
Index of Aggregate Consumption:						
Cheese	%	100.0	101.5	103.0	104.0	105.0
Condensed Products	%	100.0	101.0	102.5	103.0	104.5
Ice Cream	%	100.0	101.0	102.0	103.0	103.5
Butter	%	100.0	101.0	102.0	102.0	103.0
Skim Milk Powder	%	100.0	100.0	101.0	103.0	104.0
Index of Per Capita Consumption:						
Cheese	%	100.0	100.6	101.2	101.3	101.5
Condensed Products	%	100.0	100.1	100.7	100.3	100.9
Ice Cream	%	100.0	100.1	100.2	100.3	100.0
Butter	%	100.0	100.1	100.2	99.3	99.5
Skim Milk Powder	%	100.0	99.1	99.2	100.3	100.4

The projection for the effects of policy on farm income are presented in Table 15. In current dollars all components of gross farm income are increasing but the growth in market returns and the butterfat subsidy outweigh the increased cost of the additional levies (Export Losses) so that gross farm income increases by a solid 16.1% over the four years.

A great variety of results is possible for the path of net farm income depending on assumptions about average production costs in 1984 and how they change over time. It is assumed that these costs per HL would increase at the rate of inflation but also decrease because of technical change at one percent per year, giving the Net Farm Income estimates in Table 16 for different levels of costs of production. If production costs are low ($30/HL) relative to the CDC net target base price then net farm income available to bid or queue for quota is large as a percent of gross farm income. Moreover, net farm income will grow at about the rate of inflation and so will be little changed in real terms for all four levels of average costs of production. This is a result of a number of offsets built into the base scenario. Growth in Market Returns is due to the growth of population and per capita income, but this is offset in real terms by the decline of the subsidy and additional levies. The increase in production of about 1% per year required to maintain real gross farm income also increases total costs of production by about 1% per year because of the quantity effect. But total costs of production are stable because the quantity effect is offset by an assumed decline in costs of production of 1% per year due to technical change.

Table 15. Gross Farm Income Projections from the Base Scenario

ITEM	UNITS	1984	1985	1986	1987	1988
Farm Income Components in Current Dollars:						
Butterfat Subsidy		285.87	289.43	293.12	294.67	297.63
Export Losses		223.92	237.45	246.99	254.04	267.76
Market Returns		1914.33	1901.99	1961.41	2042.70	2149.28
Gross Farm Income		1830.24	1906.18	1958.08	2032.08	2125.71
Farm Income Components in Constant 1984 Dollars:						
Butterfat Subsidy		285.87	278.83	272.92	264.75	256.36
Export Losses		223.92	228.75	229.97	228.25	230.62
Market Returns		1814.33	1832.36	1826.27	1835.31	1851.23
Gross Farm Income		1830.24	1836.40	1823.16	1825.77	1830.93
Indices of Relative Changes in Constant 1984 Dollars:						
Butterfat Subsidy		100.0	95.5	95.5	92.6	89.7
Total Losses		100.0	102.2	102.7	101.9	103.0
Market Returns		100.0	101.0	100.7	101.2	102.0
Gross Farm Income		100.0	100.3	99.6	99.8	100.0

Table 16. Net Farm Income Projections for the Base Scenario

ITEM	Average Costs	1984	1985	1986	1987	1988
Farm Income in Current Dollars:						
Net Farm Income 1	$37.5Ø/HL	52.42	56.34	38.87	52.46	60.60
Net Farm Income 2	$35.00/HL	170.94	179.66	166.82	184.43	198.27
Net Farm Income 3	$32.50/HL	289.46	302.98	294.77	316.41	335.95
Net Farm Income 4	$30.00/HL	407.98	426.31	422.71	448.38	473.62
Farm Income in Constant 1984 Dollars:						
Net Farm Income 1	$37.50/HL	52.42	54.28	36.19	47.13	52.19
Net Farm Income 2	$35.00/HL	170.94	173.09	155.32	165.71	170.78
Net Farm Income 3	$32.50/HL	289.46	291.89	274.46	284.29	289.36
Net Farm Income 4	$30.00/HL	407.98	410.70	393.59	402.86	407.94
Indices of Constant 1984 Dollars:						
Net Farm Income 1	$37.50/HL	100.0	103.5	69.0	89.9	99.6
Net Farm Income 2	$35.00/HL	100.0	101.3	90.9	96.9	99.9
Net Farm Income 3	$32.50/HL	100.0	100.8	94.8	98.2	100.0
Net Farm Income 4	$30.00/HL	100.0	100.7	96.5	98.7	100.0

The sensitivity of net farm income to the rate of technical change is illustrated in Figure 2. The percent change in net farm income from 1984 for base average costs of production of $30/HL and $35/HL is given for rates of technical change of zero, one, and two percent. Where production costs are very close to the net target base price different rates of technical change have potentially very large impacts on net farm income.

Decreases in average costs of production of around 1% per year impose neutrality in the base scenario in terms of net farm income. This level of technical change may be somewhat conservative. Average costs of production probably will decline at least at this rate with the normal process of farm turnover with better managers entering the industry, farm expansion to take advantage of economies of scale that are available but not fully implemented, genetic improvement of cattle, etc. For the rest of the analysis a one percent decrease in costs of production per year is incorporated in estimates of net farm income.

SCENARIO 1: Elimination of the Special Export Program

The special export program was introduced in 1979 to allow the amount of MSQ to expand. In the initial years, the program probably also reduced the amount of surplus skim milk because some of the product exported was partly-skimmed evaporated milk. Now that surplus skim milk is no longer reduced by the special export program its value is questionable since it appears to involve the production of additional milk which is then sold abroad at much less than production costs.

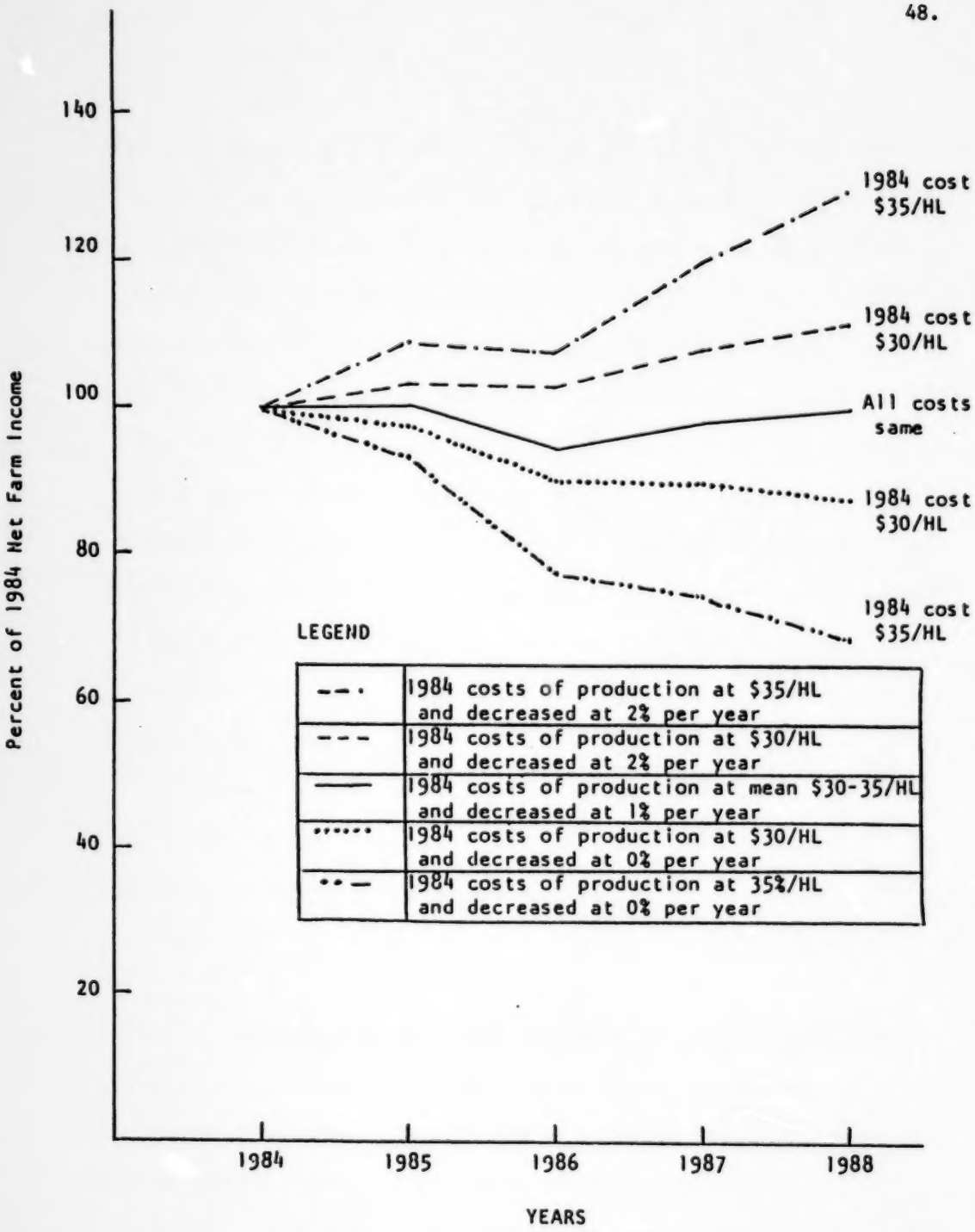

Figure 2. Base scenario changes in Net Farm Income in constant dollars with different assumptions about costs of production and technical change.

Scenario 1 incorporates the elimination of the special export program, without any other changes in policy. Support prices are maintained at the same levels as in the base scenario and Canadian Requirements are adjusted downwards to the level of Domestic Requirements only. The effect of this policy change on the consumer then is null. There would be no change in prices or availability of dairy products so aggregate and per capita consumption is identical to that in the base scenario described in Tables 13 and 14 above.

The elimination of the special export program would reduce the cost of dairy policy to the taxpayer. Milk produced for the special export program is eligible for the butterfat subsidy. With elimination of the program the total amount of the subsidy paid would decline by some $15.24 million or 5.3% of total payments in 1985 compared to payments in the existing program (the base scenario).

The major impact of the elimination of the program, however, is on the dairy farmer. The amount of milk to be produced in 1985 in standard units would decline from 48.00 mHL to 45.47 mHL or 5.3%. The impact on the farmer would be offset slightly by the growth in domestic demand: comparing 1985 production under Scenario 1 (i.e. without the special export program) with 1984 production would see a decline of 4.1%.

Furthermore, the amount of surplus powder farmers would have to fund for export would actually rise by a small amount: 96.92 mKG vs. 96.56 mKG. The special export program still tends to reduce powder exports slightly because the exported product has a slightly

lower BF:SNF ratio than the industrial milk used to maintain the program. The slightly higher level of powder exports have to be subsidized by a smaller amount of production tending to raise levy rates but this is more than offset by the elimination of losses on the exports condensed products. Consequently in 1985 the in-quota levy rate would be reduced 13.2% from the base scenario.

A key question, however, is how these adjustments all add up in terms of farm income. Gross farm income in 1985 drops without the program as shown in Table 17 because less milk is sold. Net farm income however increases; the extent of the increase depends on the cost of

Table 17. Effect of Dropping the Special Export Program on Farm Income in 1984 Dollars.

Item	1984 Production Costs	Farm Income			Increase in NFI	Total Benefits[c]
		1984	1985[a]	1985[b]		
		(1984 dollars)				
Gross Farm Income	NA	1830.24	1836.40	1770.46	NA	NA
Net Farm Income 1	37.50	52.42	54.28	81.60	27.32	42.56
Net Farm Income 2	35.00	170.94	173.09	194.75	21.66	36.90
Net Farm Income 3	32.50	289.46	291.89	307.30	15.41	30.64
Net Farm Income 4	30.00	407.98	410.70	419.84	9.14	24.38
Break-Even Production Costs:						
For Farmers Only	26.32	582.40	585.54	585.54	0.00	15.24
Socially[c]	20.29	870.65	874.49	889.73	-15.24	0.00

[a] With the Special Export Program (Base Scenario).

[b] Without the Special Export Program (Scenario 1).

[c] Sum of benefits to farmers and government costs of the butterfat subsidy.

producing milk. If costs of production for milk are close to the CDC's net target base price then there are large gains in net farm income from dropping the special export program. If the cost of producing the milk is lower then the benefits from dropping the program are lower. It is also possible[5] to calculate the level of costs of production in 1984 that would make the net farm income without the program equal to net farm income with the program taking account of changes in gross farm income and Canadian Requirements. We have called these breakeven costs and estimate them to be $26.32/HL. At production costs below $26.32/HL farmers would be worse off in terms of net farm income without the program.

There would still be a benefit for Canada from cutting the program at $26.32/HL because, even though the farmers' income is not changed, the taxpayer is better off by the because of $15.24 million of butterfat subsidy saved. Calculating break-even production costs from a social point of view,[6] it is necessary to incorporate the savings on the BF subsidy as a benefit. This drives the breakeven production costs to $20.29/HL; production costs would have to be lower than $20.29/HL on average for the program to be beneficial socially.

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5 This is done by solving the following equation for average costs, AC, of production for

1836.40 - AC * 48.00/1.01 = 1770.46 - AC * 45.47/1.01

where 48.00 and 45.47 are the Canadian Requirements for the two scenarios, 1.01 is for the assumed decrease in costs in real terms for technical change, and the other numbers are the respective gross farm incomes in 1984 dollars.

6 Butterfat subsidy savings are added to the right-hand side of the equation in the note above.

SCENARIO 2: Elimination of the Butterfat Subsidy in 1985

In Scenario 2 described in this section, the butterfat subsidy is completely reduced to zero in 1985. A large increase in support prices are assumed to be adopted in order to maintain farm income. As shown in Table 18, these support prices involve a 13.4% increase over the base 1985 support prices and a 17% increase over the 1984 support prices.

These types of support price increases do not translate into retail price increases of the same magnitude because the marketing margins, which are assumed to increase only by 3.8%, are also a major component of retail prices. Still, retail prices would increase by a large amount if the scenario 2 support prices were adopted in 1985. The policy is clearly inflationary as shown in Table 19. In terms of 1984 prices, ice cream would increase by 8%, condensed products and skim milk powder by 9%, cheese by 9% and butter, because of very small

Table 18. Comparison of Support Prices for Scenario 2 With The Base Scenario

ITEM		SUPPORT PRICE	
		Butter	Powder
		(dollars per KG)	
Year and Scenario:			
1984	Base	4.759	2.830
1985	Base	4.914	2.927
1985	Scenario 2	5.571	3.318
1985 Scenario 2 as a percent of:			
1984	Base	117.1	117.2
1985	Base	113.4	113.4

Table 19. Retail Level Prices in Scenario 2

	BASE		SCENARIO 2	INDEXED OVER	
	1984	1985		1984	1985
	(current dollars)			(percent)	
Cheese per KG	7.96	8.24	8.76	110.0	106.2
Condensed Products per L	2.20	2.28	2.40	109.2	105.4
Ice Cream per L	1.40	1.45	1.52	108.0	104.2
Butter per KG	5.45	5.63	6.25	114.7	111.0
Skim Milk Powder per KG	5.37	5.56	5.88	109.4	105.6

marketing margins, by nearly 15%. In comparison with the 1985 base these increases would be 4-11 percent.

Consumption of dairy products would therefore decline, but because of the generally small price elasticities by a much smaller amount: these declines are 1% for ice cream, 2% for condensed products and skim milk powder, 4.5% for cheese, and nearly 9% for butter in comparison with the 1985 base. Consumption declines are slightly smaller compared with 1984 because of growth in demand due to the exogenous variables. However, the result is a reduction in Canadian Requirements by 3.14 mHL or 6.5% to 44.86 mHL.

The reduction in demand and Canadian Requirements has a number of consequences. Surplus skim milk powder drops from 96.56 mKG to 79.50 mKG allowing a 8.5% reduction in the in-quota levy rate. This tends to boost farm income because total losses decline a still greater amount of 14.5%. The increased support prices boosts the "Target" Support Price in current dollars from the 1984 value of

$44.30 to $50.81 per HL. Thus the market portion of the support price is increasing by $0.48 per HL plus $6.03/HL to cover the withdrawal of subsidy. In constant dollar terms the price farmers receive (net target base price) is nearly identical to that in the Base Scenario for 1985: $38.78 and $39.21 respectively.

Market returns in Scenario 2 then are much higher than those in the corresponding base but not high enough to completely offset the reduction in the Butterfat Subsidy. Gross farm income declines in constant dollars from the 1984 level, therefore, by $136.61 million from the 1984 level or 7.5%. Net farm income need not be reduced because the costs of producing milk are reduced by the reduction in Canadian Requirements. However, it turns out that the support prices have not been raised high enough in this scenario to maintain net farm income. Net farm income declines by around $32 million (1984 dollars) for any average costs of production in the range $30.00 to $37.50 per HL.

Net farm income could be maintained with still greater boosts in the support prices, but we think it is apparent that the increase in consumer prices in Scenario 2 as described above is already very high. Policy makers would probably have to allow some decline in net farm income to implement a policy of elimination of the Butterfat Subsidy in one year.

SCENARIO 3: Gradual Elimination of the Butterfat Subsidy, 1984-88

An alternative to reduction of the butterfat subsidy in one year is to gradually eliminate it over time. A gradual change is

usually easy to accept and allows producers and others time to adjust to the new program. Moreover, some of the shortcomings of the immediate change in policy may be offset by growth in a period of more gradual change. This is the policy examined in this section. The butterfat subsidy is cut from $6.03 per HL in 1984 to zero in 1988 in stages of $4.50, $3.00 and $1.50 per HL in each of 1985, 1986 and 1987.

As in Scenario 2 support prices are increased to maintain farm income. The pattern proposed for support prices is given in Table 20. The support price of butter in 1988 represents nearly a 26% increase over that of 1984 and that of skim milk powder is nearly a 24% increase. The rate of increase is slightly above the anticipated inflation rate but not unreasonably so. The 1988 support prices for this scenario are less than 10% higher than the base scenario which approximated the rate of inflation.

Table 20. Support Prices for Scenario 3

ITEM	1984	1985	1986	1987	1988
Support Prices in Current Dollars per KG:					
Butter	4.759	4.988	5.303	5.637	5.988
Skim Milk Powder	2.830	2.960	3.130	3.310	3.500
Percent of 1984:					
Butter	100.0	104.8	111.4	118.4	125.8
Skim Milk Powder	100.0	104.6	110.6	117.0	123.7
Percent of Base Scenario:					
Butter	100.0	101.5	104.3	106.6	108.3
Powder	100.0	101.1	104.5	107.2	109.3

Consumer prices that correspond to this set of support prices are given in Table 21. These prices are of course increasing more quickly than the inflation rate but not as quickly as the support prices. This is because the increase in the retail prices are a weighted average of the rate of increase in the farm prices and in the farm-retail margins. The price of butter increases the most rapidly in current dollars because it

Table 21. Retail Level Prices for Industrial Milk Products for Scenario 3.

ITEM	UNITS	1984	1985	1986	1987	1988
Consumer Prices in Current Dollars:						
Cheese	$/KG	7.96	8.30	8.66	9.08	9.55
Condensed Products	$/L	2.20	2.29	2.39	2.50	2.63
Ice Cream	$/L	1.40	1.46	1.52	1.59	1.67
Butter	$/KG	5.45	5.70	6.04	6.41	6.79
Skim Milk Powder	$/KG	5.37	5.60	5.86	6.14	6.45
Index in Current Dollars:						
Cheese	%	100.0	104.3	108.8	114.1	120.1
Condensed Products	%	100.0	104.3	108.6	113.7	119.5
Ice Cream	%	100.0	104.1	108.5	113.4	119.0
Butter	%	100.0	104.7	110.9	117.5	124.6
Skim Milk Powder	%	100.0	104.2	109.1	114.3	120.1
Index in Constant 1984 Dollars:						
Cheese	%	100.0	100.5	101.3	102.5	103.4
Condensed Products	%	100.0	100.4	101.1	102.2	102.9
Ice Cream	%	100.0	100.3	101.0	101.9	102.5
Butter	%	100.0	100.9	103.3	105.6	107.3
Skim Milk Powder	%	100.0	100.4	101.6	102.7	103.4
Percent of Base Scenario:						
Cheese	%	100.0	100.7	102.4	103.7	104.8
Condensed Products	%	100.0	100.6	102.1	103.3	104.2
Ice Cream	%	100.0	100.5	101.5	102.3	102.9
Butter	%	100.0	101.3	103.7	105.7	107.2
Skim Milk Powder	%	100.0	100.6	102.3	103.8	104.8

has the smallest marketing margin. Conversely, the price of ice cream increases at the slowest rate so that the price spread between these two increases the most in relative terms.

The impact of these support prices on consumption is shown in Table 22. Consumption of butter decreases three percent despite increases in population and per capita incomes because of the price increase. In fact, consumption of butter decreases by nearly six percent in comparison with the base scenario. Slight increases in consumption are projected for the other commodities ranging from 1.0 to 3.5%. The increases are due to population growth as per capita consumption is down for all products except ice cream. Thus, the price effect of the increased support prices in real terms is stronger than the income effect over the period. The exception, ice cream, is because of the smaller change in price for ice cream combined with an income elasticity of 0.38 as noted in Table 3.

The effect of this scenario on the consumer would appear to be quite acceptable. Aggregate consumption for most dairy products continues to grow while per capita consumption declines by only a small amount and price increases are kept within reasonable bounds.

The delicate balance attained by this set of support prices is illustrated in Table 23. Canadian Requirements hardly change at all. They increase slightly and decrease thereafter but never change by more than 0.5% from those in 1984.

A very positive aspect of the program is the decline in the surplus skim milk powder produced annually. This too increases

Table 22. Aggregate and Per Capita Consumption of Industrial Dairy Products in Scenario 3.

ITEM	UNITS	1984	1985	1986	1987	1988
Aggregate Consumption:						
Cheese	mKG	200.99	203.01	204.02	204.02	204.02
Condensed Products	mL	60.00	60.60	61.20	61.20	61.80
Ice Cream	mL	310.00	313.10	316.20	317.75	320.85
Butter	mKG	107.53	107.53	106.46	105.39	104.32
Skim Milk Powder	mKG	45.22	45.22	45.67	45.67	45.67
Index of Aggregate Consumption:						
Cheese	%	100.0	101.0	101.5	101.5	101.5
Condensed Products	%	100.0	101.0	102.0	102.0	103.0
Ice Cream	%	100.0	101.0	102.0	102.5	103.5
Butter	%	100.0	100.0	99.0	98.0	97.0
Skim Milk Powder	%	100.0	100.0	101.0	101.0	101.0
Index of Per Capita Consumption:						
Cheese	%	100.0	100.1	99.7	98.8	98.1
Condensed Products	%	100.0	100.1	100.2	99.3	99.5
Ice Cream	%	100.0	100.1	100.2	99.8	100.0
Butter	%	100.0	99.1	97.2	95.4	93.7
Skim Milk Powder	%	100.0	99.1	99.2	98.3	97.6
Percent of Base Scenario:						
Cheese	%	100.0	99.5	98.5	97.6	96.7
Condensed Products	%	100.0	100.0	99.5	99.0	98.6
Ice Cream	%	100.0	100.0	100.0	99.5	100.0
Butter	%	100.0	99.0	97.1	96.1	94.2
Skim Milk Powder	%	100.0	100.0	100.0	98.1	97.1

Table 23. The Target Variables in Scenario 3

ITEM	UNITS	1984	1985	1986	1987	1988
Target Variables in Current Dollars:						
Canadian Requirements[a]	mKG	47.41	47.66	47.59	47.38	47.21
Surplus Skim Milk Powder	mKG	93.44	94.62	92.78	91.58	90.41
"Target" Support Price	$/HL	44.30	44.71	45.36	46.58	47.90
In-quota Levy	$/HL	4.74	4.98	5.20	5.48	5.76
Butterfat Subsidy	m$	285.87	214.45	142.78	71.07	0.00
Percent of 1984 in Current Dollars:						
Canadian Requirements	%	100.0	100.5	100.4	99.9	99.6
Surplus Skim Milk Powder	%	100.0	101.3	99.3	98.0	96.8
"Target" Support Price	%	100.0	100.9	102.4	105.1	108.1
In-quota Levy	%	100.0	105.0	109.6	115.5	121.5
Butterfat Subsidy	%	100.0	75.0	49.9	24.9	0.0
Percent of Base Scenario:						
Canadian Requirements	%	100.0	99.3	97.9	97.0	95.6
Surplus Skim Milk Powder	%	100.0	98.0	93.9	92.8	89.7
"Target" Support Price	%	100.0	97.8	97.8	97.4	96.6
In-quota Levy	%	100.0	100.4	102.2	105.4	106.4
Butterfat Subsidy	%	100.0	74.1	48.7	24.1	0.0

[a] Including the Special Export Program

initially but then declines to a level in 1988 of 96.8% of that in 1984 and 10.3% less than the 1988 base scenario surplus. The decline in the skim milk powder surplus is because of the decline in butter consumption. Additional butter consumption at the margin creates powder surplus because it tends to increase the national BF:SNF ratio in consumption.

The real balance achieved between the reduction in the Butterfat Subsidy rates and the support prices is seen in the values

for the "Target" Support Price in Scenario 3. In current dollars, it increases by a small amount each year. Unfortunately, higher support prices also increase the costs associated with purchasing surplus powder and the evaporated products needed for the special export program. It is assumed that exported products in Scenario 3 are sold at the same price as in the base scenario so export losses per unit are larger: large enough to outweigh the gains made in reduced powder exports. Consequently the in-quota levy must increase at a rate greater than the rate of inflation. However, the increase in the "Target" Support Price outweighs the increase in the in-quota levy so the CDC net target base price is still positive in every year increasing from $39.39/HL in 1984 to $41.97/HL in 1988.

The butterfat subsidy, of course, is reduced by approximately 25% every year, which is the objective assumed for the scenario.

Thus, in terms of the target variables, the policy effects a number of small changes. The real problem is that these changes are all in current dollars. Approximately constant farm level prices in current dollars mean declining farm level prices in real terms at approximately the rate of inflation. The comparisons of the target variables in Scenario 3 with those in the base scenario are suggestive of the impacts on farmers. The real impact, however, shows up when net farm income is calculated.

Turning first to the components of gross farm income (Table 24), note that since prices are increasing slightly in current dollars and production is constant, gross farm income is increasing. The increase in market returns more than offsets the changes in levies and

Table 24. Gross Farm Income by Component for Scenario 3.

ITEM	1984	1985	1986	1987	1988
Farm Income Components in Current Dollars:					
Butterfat Subsidy	285.87	214.45	142.78	71.07	0.00
Total Losses	223.92	236.66	246.96	259.32	271.89
Market Returns	1814.33	1916.08	2016.01	2135.84	2261.28
Gross Farm Income	1830.24	1846.07	1862.37	1896.35	1935.94
Farm Income Components in Constant 1984 Dollars:					
Butterfat Subsidy	285.87	206.60	132.94	63.86	0.00
Total Losses	223.92	228.00	229.94	232.99	234.19
Market Returns	1814.33	1845.93	1877.11	1919.00	1947.70
Gross Farm Income	1830.24	1778.49	1734.05	1703.82	1667.47
Indices of Constant 1984 Dollars:					
Butterfat Subsidy	100.0	72.3	46.5	22.3	0.0
Total Losses	100.0	101.8	102.7	104.0	104.6
Market Returns	100.0	101.7	103.5	105.8	107.4
Gross Farm Income	100.0	97.2	94.7	93.1	91.1
Percent of Base Scenario:					
Butterfat Subsidy	100.0	74.1	48.7	24.1	0.0
Total Losses	100.0	99.7	100.0	102.1	101.5
Market Returns	100.0	100.7	102.8	104.6	105.2
Gross Farm Income	100.0	96.8	95.1	93.3	91.1

the butterfat subsidy. In constant dollars, however, gross farm income declines by more than 2% per year throughout the adjustment period and by a similar amount in comparison with the base scenario.

Costs of production of milk, however, are assumed to increase because of inflation causing net farm income (Table 25) to decline in current dollars. Again the declines are largest if a high cost of production such as $37.50/HL is assumed. If a lower cost of

Table 25. Net Farm Income for Scenario 3

ITEM	Average Costs[a]	1984	1985	1986	1987	1988
Farm Income in Current Dollars:						
Net Farm Income 1	$37.50	52.42	9.44	-16.67	-23.11	-39.22
Net Farm Income 2	$35.00	170.94	131.88	108.60	104.85	92.45
Net Farm Income 3	$32.50	289.46	254.32	233.87	232.82	224.13
Net Farm Income 4	$30.00	407.98	376.76	359.14	360.78	355.81
Farm Income in Constant 1984 Dollars:						
Net Farm Income 1	$37.50	52.42	9.09	-15.52	-20.77	-33.78
Net Farm Income 2	$35.00	170.94	127.05	101.12	94.21	79.63
Net Farm Income 3	$32.50	289.46	245.01	217.76	209.18	193.05
Net Farm Income 4	$30.00	407.98	362.97	334.40	324.15	306.47
Indices of Constant 1984 Dollars:						
Net Farm Income 1	$37.50	100.0	17.3	-29.6	-39.6	-64.4
Net Farm Income 2	$35.00	100.0	74.3	59.2	55.1	46.6
Net Farm Income 3	$32.50	100.0	84.6	75.2	72.3	66.7
Net Farm Income 4	$30.00	100.0	89.0	82.0	79.5	75.1
Percent of Base Scenario:						
Net Farm Income 1	$37.50	100.0	8.1	-16.6	-19.9	-30.8
Net Farm Income 2	$35.00	100.0	58.0	50.2	44.5	36.7
Net Farm Income 3	$32.50	100.0	72.5	67.9	63.3	57.6
Net Farm Income 4	$30.00	100.0	79.5	76.1	72.2	67.5

[a] Average Costs of Production in 1984 Dollars per HL.

production such as $30.00/HL is assumed then the decline of net farm income is $52.17 million or more than ten percent. Measured in constant dollars the declines in net farm income are still larger ranging from more than 100 percent to 249 percent as costs of production range from $37.50/HL to $30.00/HL.

Without doubt the elimination of the butterfat subsidy would be difficult for producers even if introduced gradually as in this scenario. Of particular concern are those producers whose costs are

near $37.50/HL as these rely on the Butterfat Subsidy for net income. Those with low costs on the other hand would not be hurt nearly as badly. The policy maker should therefore look to further analysis of the implementation if this policy were to be considered further.

SCENARIO 4: Reduction of the Butterfat Subsidy and Butter Imports

In Scenario 4 a reduction in the butterfat subsidy is introduced but not the complete elimination. The full subsidy is maintained throughout for the first 31 mHL of Canadian Requirements plus the special export program. The subsidy on the remaining Canadian Requirements is reduced as in Scenario 3 in stages. At the same time the amount of MSQ is reduced also in stages to 31 mHL in 1988. In effect, two classes of milk are created during the transition but by 1988 only one class of milk is produced again. The subsidy rates and amount of milk eligible are given in Table 26.

Table 26. Butterfat Subsidy and MSQ (Canadian Requirements) By Year for Scenario 4.

YEAR	CLASS 1		CLASS 2		Canadian Requirements
	Subsidy	Amount	Subsidy	Amount	
	($/HL)	(mHL)	($/HL)	(mHL)	(mHL)
1984	6.03	47.60	N.A.	N.A.	47.60
1985	6.03	31.00	4.50	12.45	43.45
1986	6.03	31.00	3.00	8.30	39.30
1987	6.03	31.00	1.50	4.15	35.15
1988	6.03	31.00	0.00	0.00	31.00

The support prices utilized in Scenario 4 are the same as those for Scenario 3. These support prices would be ineffective, of course, with the amount of production specified in Table 26. To make the support prices effective butter imports are allowed so that butter supplies and demand are just satisfied. The amount of butter imports allowed then becomes the variable which balances support prices and the level of MSQ. This is different from other scenarios in which zero butter imports or exports is achieved by adjustments in MSQ. The procedure, however, involves only a variation to the solution of equations 6 described above.

A lower limit is also put on the reduction in Canadian Requirements. The lower limit is based upon self-sufficiency in skim milk powder. Of the 93.44 mKG of powder "exported" in 1984 approximately 10.00 mKG is disposed in Canada in the form of animal feed and baby food at prices between the support price and world price. Despite the reduction in MSQ and the shifting of the BF:SNF supply ratio through allowing butter imports, a minimum 10.00 mKG of surplus powder is to be maintained and the decline in Canadian Requirements envisaged in Table 26, appropriately modified when this floor is hit.

The world price for butter imports is assumed to be $1.40 per Kg in 1985 and increase by $0.10 per Kg for the rest of the period. This, of course, is far below the wholesale price the government would receive (the support price) when sold in Canada. Thus profits on butter imports is the difference between the world price and the support price. These profits are assumed to be split between the taxpayer and farmer equally. Thus the imports from the government

point of view is seen as compensation for continuing the butterfat subsidy, at least in reduced form, and for the farm community as compensation for the reduction in production and loss of part of the butterfat subsidy.

The impact of Scenario 4 on demand and the consumer is identical to Scenario 3 and Tables 21 and 22 may be referred to by the interested reader. Prices in general are a bit above the general inflation rate with slight declines in per capita consumption. Aggregate consumption is equivalent to the small decline in Canadian Requirements noted above in Table 23.

Canadian Requirements in terms of domestic production do not decline as rapidly or nearly as far as anticipated in Table 26. Because of the additional constraint on surplus skim milk powder, as shown in Table 27, Canadian Requirements are reduced to only 37.57 mHL in 1987 and 37.54 mHL in 1988 rather than the eventual 31 mHL given in Table 26. Because of the reduction in powder, exports levies are greatly reduced although a significant levy of $2.15/HL remains in 1988 for the 10 mKG of surplus skim milk powder and to maintain the special export program.

The "Target" Support price is increasing at a faster rate for this scenario than in Scenario 3. These values may be compared with the corresponding values for Scenario 3 where the support prices increase at the same rate but the butterfat subsidy is cut more rapidly. Farmers are still better off in Scenario 4 than in Scenario 3 because of the decline in the levy rate. The CDC's net target base price would therefore be 102.2, 106.3, 109.7 and 110.6 percent of 1984

Table 27. Target Variables for Scenario 4

ITEM	UNITS	1984	1985	1986	1987	1988
Target Variables in Current Dollars:						
Canadian Requirements	mHL	47.41	43.45	39.30	37.57	37.54
Surplus Skim Milk Powder	mKG	93.44	59.13	23.57	10.00	10.00
"Target" Support Price	$/HL	44.30	45.73	47.61	50.14	52.71
In-quota Levy	$/HL	4.74	3.77	2.40	1.81	1.94
Butterfat Subsidy	m$	285.87	242.95	211.83	196.78	186.93
Percent of 1984:						
Canadian Requirements	%	100.0	91.7	82.9	79.2	79.2
Surplus Skim Milk Powder	%	100.0	63.3	25.2	10.7	10.7
"Target" Support Price	%	100.0	103.2	107.5	113.2	119.0
In-quota Levy	%	100.0	79.5	50.7	38.3	40.9
Butterfat Subsidy	%	100.0	85.0	74.1	68.8	65.4
Percent of Base Scenario:						
Canadian Requirements	%	100.0	90.5	80.8	76.9	76.0
Surplus Skim Milk Powder	%	100.0	61.2	23.8	10.1	9.9
"Target" Support Price	%	100.0	102.6	104.8	106.7	107.6
In-quota Levy	%	100.0	76.0	47.3	34.9	35.8
Butterfat Subsidy	%	100.0	83.9	72.3	66.8	62.8

in constant dollars for 1985-88 respectively. The farmer is receiving a much higher price in real terms than in the base scenario and Scenario 3.

The butterfat subsidy declines in Scenario 4 but not nearly as much as in Scenario 3. Savings for the taxpayers are $98.94 m in current dollars or $124.84 in constant 1984 dollars for 1988. Because the subsidy is tied thereafter to a fixed amount of milk 31 mHL) the subsidy would decline at the rate of inflation with no offset by the increase in demand. The cost to the taxpayer of the butterfat subsidy is further offset by his share of the profits on butter imports. The farmer's share of these profits is given in Table 28 as "Butter Imports", but the taxpayer receives

the same amount so the entire cost of the dairy program to the taxpayer in current dollars would be 210.26, 143.77, 111.58 and 97.75 in 1985, 1986, 1987, and 1988 respectively. In constant 1984 dollars, a savings from 1984 of $201.67 m or more than 70% is achieved.

Gross farm income is stagnant in the adjustment period in this scenario falling slightly to 1986 when production cuts outweigh price increases. Thereafter farm income rises because of increasing prices and increasing profits on butter imports. Gross farm income remains nearly 9% below that in the base scenario, however.

Net farm income looks much better than in the Base Scenario. In constant dollars, in 1988 net farm income increases by between $177.60 m and $262.63 m (43.5 to 501.0 percent) depending on assumptions for the average costs of production as shown in Table 29. Moreover, it increases in constant dollar terms for all years and all assumed values for costs of production. Clearly farmers as a whole would be better off with this program than with the base scenario although there may be problems of implementation so that all farmers individually can be better off. This is particularly so because of the large reduction in production.

Like Scenario 1, Scenario 4 appears to benefit all participants. Producers as well as taxpayers gain together by around $200 m per year by 1988 under this program as compared to the base scenario. The consumer, however, has been made worse off by the higher support prices. Large gains would probably still be achievable with the base set of support prices so that the consumer does not pay higher prices

Table 28. Components of Gross Farm Income in Scenario 4

ITEM	1984	1985	1986	1987	1988
Farm Income Components in Current Dollars:					
Butterfat Subsidy	285.87	242.95	211.83	196.78	186.93
Butter Imports	0.00	32.69	68.06	85.20	89.18
Total Losses	223.92	165.27	98.54	73.33	77.94
Market Returns	1814.33	1744.04	1659.11	1686.77	1791.50
Gross Farm Income	1830.24	1806.61	1790.61	1844.17	1936.22
Farm Income Components in Constant 1984 Dollars:					
Butterfat Subsidy	285.87	234.06	197.23	176.80	161.01
Butter Imports	0.00	31.49	63.37	76.55	76.82
Total Losses	223.92	159.22	91.75	65.89	67.13
Market Returns	1814.33	1680.19	1544.79	1515.52	1543.06
Gross Farm Income	1830.24	1740.47	1667.58	1656.94	1667.72
Indices of Constant 1984 Dollars:					
Butterfat Subsidy	100.0	81.9	69.0	61.8	56.3
Total Losses	100.0	71.1	41.0	29.4	30.0
Market Returns	100.0	92.6	85.1	83.5	85.0
Gross Farm Income	100.0	95.1	91.1	90.5	91.1
Percent of Base Scenario:					
Butterfat Subsidy	100.0	83.9	72.3	66.8	62.8
Total Losses	100.0	69.6	39.9	28.9	29.1
Market Returns	100.0	91.7	84.6	82.6	83.4
Gross Farm Income	100.0	94.8	91.5	90.8	91.1

Table 29. Net Farm Income in Scenario 4

ITEM	Average Costs[a]	1984	1985	1986	1987	1988
Farm Income in Current Dollars:						
Net Farm Income 1	$37.50	52.42	132.06	239.37	322.35	365.77
Net Farm Income 2	$35.00	170.94	243.70	342.81	423.81	470.47
Net Farm Income 3	$32.50	289.46	355.33	446.25	525.26	575.16
Net Farm Income 4	$30.00	407.98	466.97	549.69	626.72	679.86
Farm Income in Constant 1984 Dollars:						
Net Farm Income 1	$37.50	52.42	127.23	222.87	289.63	315.05
Net Farm Income 2	$35.00	170.94	234.78	319.19	380.78	405.23
Net Farm Income 3	$32.50	289.46	342.33	415.50	471.93	495.40
Net Farm Income 4	$30.00	407.98	449.88	511.82	563.09	585.58
Indices of Constant 1984 Dollars:						
Net Farm Income 1	$37.50	100.0	242.7	425.2	552.5	601.0
Net Farm Income 2	$35.00	100.0	137.3	186.7	222.8	237.1
Net Farm Income 3	$32.50	100.0	118.3	143.5	163.0	171.1
Net Farm Income 4	$30.00	100.0	110.3	125.5	138.0	143.5
Percent of Base Scenario:						
Net Farm Income 1	$37.50	100.0	234.4	615.8	614.5	603.6
Net Farm Income 2	$35.00	100.0	135.6	205.5	229.8	237.3
Net Farm Income 3	$32.50	100.0	117.3	151.4	166.0	171.2
Net Farm Income 4	$30.00	100.0	109.5	130.0	139.8	143.5

[a] Average Costs of Production in 1984 Dollars per HL.

and thus a smaller decrease in Canadian production would therefore be necessary than that shown in Scenario 4.

The reason for the gain to the Canadian Economy in Scenario 4 should be apparent. Subsidies paid by Canadians to the world economy in the form of skim milk powder exports are being exchanged for subsidies obtained from the world economy in the form of butter imports. The nation gets the benefits of the foreign subsidies plus the ability to match the BF:SNF ratio in demand to the BF:SNF ratio in supply by augmenting Canadian produced milk with foreign produced butter. The levels of the butter fat subsidy, amount of milk eligible for the subsidy, disposition of butter import profits, and support prices serve to distribute these gains among producers, consumers and taxpayers.

CONCLUSIONS

One purpose in preparing this report was to document and demonstrate a technique for analyzing and evaluating dairy policy. The technique of course depends a great deal on values selected for parameters such as demand elasticities, population projections and costs of production. The analysis does point out how critical knowledge of these parameters is for an evaluation of policy. Given that good estimates of these can be obtained, the method is appropriate for evaluation of the effects of a wide range of policies on taxpayers, consumers, and on farmers as a whole. An important reservation, however, is that the distribution of these effects on farmers in different regions, with different amounts of quota, efficiencies, etc. are not dealt with. This would be an appropriate approach to be taken in a study concentrating on the supply side. Furthermore the distribution of policy inputs on consumers by income class, etc. and on the processing industry itself is not dealt with.

Three approaches to reduction of the cost of the butterfat subsidy were evaluated. Scenario 2 simulates the effects of dropping the butterfat subsidy in 1985 and increasing support prices by approximately 17 percent to maintain target returns. This scenario was found to involve dairy price increases of 8-15 percent at the consumer level but still result in substantial declines in farm income. Implementation of this policy gradually over 1985-88 did make the policy appear more attractive. This is because inflation would tend to mask some of the effects and growth and technical change would off-set some of the effects. Thus, the pressure to adjust would be

ameliorated for both farmers and consumers. The final approach involved allowing butter imports (Scenario 4). This approach clearly enables farmers to achieve high incomes while simultaneously reducing the cost of the butterfat subsidy. This attractive result follows from the fact that the program essentially involves the substitution of butter imports (at less than our costs of production) for skim milk powder exports (at a loss). Substantial reduction in Canadian Requirements would, however, be necessary.

The elimination of the special export program (Scenario 1) would also have a favourable effect on farm incomes and reduce the butterfat subsidy marginally. Again, milk production would need to be reduced but the Canadian economy would be improved by the elimination of products exported at a loss.

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APPENDIX

Table 30: Demand for Low Fat Fluid Milk for 1984

PERCENT OF HISTORICAL DEMAND	QUANTITY	PRICE	PRICE INDEX	SALES	AREA
85.0	1477.30	1.39	179.35	2052.	3869.
85.5	1485.99	1.37	177.48	2043.	3881.
86.0	1494.68	1.36	175.61	2033.	3893.
86.5	1503.37	1.35	173.74	2023.	3905.
87.0	1512.06	1.33	171.87	2013.	3917.
87.5	1520.75	1.32	170.00	2003.	3928.
88.0	1529.44	1.30	168.14	1992.	3940.
88.5	1538.13	1.29	166.27	1981.	3951.
89.0	1546.82	1.27	164.40	1970.	3962.
89.5	1555.51	1.26	162.53	1958.	3973.
90.0	1564.20	1.24	160.66	1947.	3984.
90.5	1572.89	1.23	158.80	1935.	3995.
91.0	1581.58	1.22	156.93	1922.	4005.
91.5	1590.27	1.20	155.06	1910.	4016.
92.0	1598.96	1.19	153.19	1897.	4026.
92.5	1607.65	1.17	151.32	1884.	4036.
93.0	1616.34	1.16	149.45	1871.	4046.
93.5	1625.03	1.14	147.59	1858.	4056.
94.0	1633.72	1.13	145.72	1844.	4066.
94.5	1642.41	1.11	143.85	1830.	4076.
95.0	1651.10	1.10	141.98	1816.	4086.
95.5	1659.79	1.09	140.11	1801.	4095.
96.0	1668.48	1.07	138.25	1787.	4105.
96.5	1677.17	1.06	136.38	1772.	4114.
97.0	1685.86	1.04	134.51	1756.	4123.
97.5	1694.55	1.03	132.64	1741.	4132.
98.0	1703.24	1.01	130.77	1725.	4141.
98.5	1711.93	1.00	128.90	1709.	4149.
99.0	1720.62	0.98	127.04	1693.	4158.
99.5	1729.31	0.97	125.17	1677.	4167.
100.0	1738.00	0.96	123.30	1660.	4175.
100.5	1746.69	0.94	121.43	1643.	4183.
101.0	1755.38	0.93	119.56	1626.	4191.
101.5	1764.07	0.91	117.70	1608.	4199.
102.0	1772.76	0.90	115.83	1590.	4207.
102.5	1781.45	0.88	113.96	1573.	4215.
103.0	1790.14	0.87	112.09	1554.	4222.
103.5	1798.83	0.85	110.22	1536.	4230.
104.0	1807.52	0.84	108.35	1517.	4237.
104.5	1816.21	0.82	106.49	1498.	4245.
105.0	1824.90	0.81	104.62	1479.	4252.
105.5	1833.59	0.80	102.75	1459.	4259.
106.0	1842.28	0.78	100.88	1440.	4265.
106.5	1850.97	0.77	99.01	1420.	4272.
107.0	1859.66	0.75	97.15	1399.	4279.
107.5	1868.35	0.74	95.28	1379.	4285.
108.0	1877.04	0.72	93.41	1358.	4292.
108.5	1885.73	0.71	91.54	1337.	4298.
109.0	1894.42	0.69	89.67	1316.	4304.
109.5	1903.11	0.68	87.80	1294.	4310.
110.0	1911.80	0.67	85.94	1273.	4316.
110.5	1920.49	0.65	84.07	1251.	4321.
111.0	1929.18	0.64	82.20	1228.	4327.
111.5	1937.87	0.62	80.33	1206.	4333.
112.0	1946.56	0.61	78.46	1183.	4338.
112.5	1955.25	0.59	76.60	1160.	4343.
113.0	1963.94	0.58	74.73	1137.	4348.
113.5	1972.63	0.56	72.86	1113.	4353.
114.0	1981.32	0.55	70.99	1090.	4358.
114.5	1990.01	0.54	69.12	1065.	4363.
115.0	1998.70	0.52	67.25	1041.	4367.

Table 31: Demand for Standard Fluid Milk for 1984

PERCENT OF HISTORICAL DEMAND	QUANTITY	PRICE	PRICE INDEX	SALES	AREA
85.0	720.80	1.38	177.70	992.	1853.
85.5	725.04	1.36	175.88	988.	1858.
86.0	729.28	1.35	174.07	983.	1864.
86.5	733.52	1.33	172.26	979.	1870.
87.0	737.76	1.32	170.44	974.	1876.
87.5	742.00	1.31	168.63	969.	1881.
88.0	746.24	1.29	166.82	964.	1887.
88.5	750.48	1.28	165.00	959.	1892.
89.0	754.72	1.26	163.19	954.	1897.
89.5	758.96	1.25	161.38	949.	1903.
90.0	763.20	1.24	159.56	943.	1908.
90.5	767.44	1.22	157.75	938.	1913.
91.0	771.68	1.21	155.94	932.	1918.
91.5	775.92	1.19	154.13	926.	1923.
92.0	780.16	1.18	152.31	920.	1929.
92.5	784.40	1.17	150.50	914.	1933.
93.0	788.64	1.15	148.69	908.	1938.
93.5	792.88	1.14	146.87	902.	1943.
94.0	797.12	1.12	145.06	896.	1948.
94.5	801.36	1.11	143.25	889.	1953.
95.0	805.60	1.10	141.43	883.	1957.
95.5	809.84	1.08	139.62	876.	1962.
96.0	814.08	1.07	137.81	869.	1967.
96.5	818.32	1.05	135.99	862.	1971.
97.0	822.56	1.04	134.18	855.	1976.
97.5	826.80	1.03	132.37	848.	1980.
98.0	831.04	1.01	130.55	840.	1984.
98.5	835.28	1.00	128.74	833.	1989.
99.0	839.52	0.98	126.93	825.	1993.
99.5	843.76	0.97	125.11	818.	1997.
100.0	848.00	0.96	123.30	810.	2001.
100.5	852.24	0.94	121.49	802.	2005.
101.0	856.48	0.93	119.67	794.	2009.
101.5	860.72	0.91	117.86	786.	2013.
102.0	864.96	0.90	116.05	778.	2017.
102.5	869.20	0.88	114.23	769.	2020.
103.0	873.44	0.87	112.42	761.	2024.
103.5	877.68	0.86	110.61	752.	2028.
104.0	881.92	0.84	108.79	743.	2031.
104.5	886.16	0.83	106.98	734.	2035.
105.0	890.40	0.81	105.17	725.	2038.
105.5	894.64	0.80	103.35	716.	2042.
106.0	898.88	0.79	101.54	707.	2045.
106.5	903.12	0.77	99.73	698.	2049.
107.0	907.36	0.76	97.91	688.	2052.
107.5	911.60	0.74	96.10	679.	2055.
108.0	915.84	0.73	94.29	669.	2058.
108.5	920.08	0.72	92.48	659.	2061.
109.0	924.32	0.70	90.66	649.	2064.
109.5	928.56	0.69	88.85	639.	2067.
110.0	932.80	0.67	87.04	629.	2070.
110.5	937.04	0.66	85.22	619.	2073.
111.0	941.28	0.65	83.41	608.	2076.
111.5	945.52	0.63	81.60	598.	2078.
112.0	949.76	0.62	79.78	587.	2081.
112.5	954.00	0.60	77.97	576.	2084.
113.0	958.24	0.59	76.16	565.	2086.
113.5	962.48	0.58	74.34	554.	2089.
114.0	966.72	0.56	72.53	543.	2091.
114.5	970.96	0.55	70.72	532.	2093.
115.0	975.20	0.53	68.90	520.	2096.

Table 32: Demand for Cheese for 1984

PERCENT OF HISTORICAL DEMAND	QUANTITY	PRICE	PRICE INDEX	SALES	AREA
85.0	171.70	9.59	159.85	1647.	2442.
85.5	172.71	9.54	158.94	1647.	2452.
86.0	173.72	9.48	158.03	1647.	2461.
86.5	174.73	9.43	157.12	1647.	2471.
87.0	175.74	9.37	156.21	1647.	2480.
87.5	176.75	9.32	155.31	1647.	2490.
88.0	177.76	9.26	154.40	1647.	2499.
88.5	178.77	9.21	153.49	1646.	2508.
89.0	179.78	9.15	152.58	1646.	2518.
89.5	180.79	9.10	151.67	1645.	2527.
90.0	181.80	9.05	150.76	1645.	2536.
90.5	182.81	8.99	149.86	1644.	2545.
91.0	183.82	8.94	148.95	1643.	2554.
91.5	184.83	8.88	148.04	1642.	2563.
92.0	185.84	8.83	147.13	1641.	2572.
92.5	186.85	8.77	146.22	1639.	2581.
93.0	187.86	8.72	145.31	1638.	2590.
93.5	188.87	8.66	144.41	1636.	2599.
94.0	189.88	8.61	143.50	1635.	2607.
94.5	190.89	8.56	142.59	1633.	2616.
95.0	191.90	8.50	141.68	1631.	2625.
95.5	192.91	8.45	140.77	1629.	2633.
96.0	193.92	8.39	139.87	1627.	2642.
96.5	194.93	8.34	138.96	1625.	2650.
97.0	195.94	8.28	138.05	1623.	2659.
97.5	196.95	8.23	137.14	1621.	2667.
98.0	197.96	8.17	136.23	1618.	2675.
98.5	198.97	8.12	135.32	1616.	2684.
99.0	199.98	8.06	134.42	1613.	2692.
99.5	200.99	8.01	133.51	1610.	2700.
100.0	202.00	7.96	132.60	1607.	2708.
100.5	203.01	7.90	131.69	1604.	2716.
101.0	204.02	7.85	130.78	1601.	2724.
101.5	205.03	7.79	129.88	1598.	2732.
102.0	206.04	7.74	128.97	1594.	2740.
102.5	207.05	7.68	128.06	1591.	2747.
103.0	208.06	7.63	127.15	1587.	2755.
103.5	209.07	7.57	126.24	1584.	2763.
104.0	210.08	7.52	125.33	1580.	2770.
104.5	211.09	7.47	124.43	1576.	2778.
105.0	212.10	7.41	123.52	1572.	2785.
105.5	213.11	7.36	122.61	1568.	2793.
106.0	214.12	7.30	121.70	1564.	2800.
106.5	215.13	7.25	120.79	1559.	2808.
107.0	216.14	7.19	119.88	1555.	2815.
107.5	217.15	7.14	118.98	1550.	2822.
108.0	218.16	7.08	118.07	1545.	2829.
108.5	219.17	7.03	117.16	1541.	2837.
109.0	220.18	6.98	116.25	1536.	2844.
109.5	221.19	6.92	115.34	1531.	2851.
110.0	222.20	6.87	114.44	1526.	2858.
110.5	223.21	6.81	113.53	1520.	2864.
111.0	224.22	6.76	112.62	1515.	2871.
111.5	225.23	6.70	111.71	1510.	2878.
112.0	226.24	6.65	110.80	1504.	2885.
112.5	227.25	6.59	109.89	1498.	2892.
113.0	228.26	6.54	108.99	1493.	2898.
113.5	229.27	6.48	108.08	1487.	2905.
114.0	230.28	6.43	107.17	1481.	2911.
114.5	231.29	6.38	106.26	1475.	2918.
115.0	232.30	6.32	105.35	1468.	2924.

Table 33: Demand for Condensed/Evaporated for 1984

PERCENT OF HISTORICAL DEMAND	QUANTITY	PRICE	PRICE INDEX	SALES	AREA
85.0	51.00	3.08	178.34	157.	281.
85.5	51.30	3.05	176.69	156.	282.
86.0	51.60	3.02	175.04	156.	282.
86.5	51.90	2.99	173.38	155.	283.
87.0	52.20	2.97	171.73	155.	284.
87.5	52.50	2.94	170.08	154.	285.
88.0	52.80	2.91	168.43	154.	286.
88.5	53.10	2.88	166.78	153.	287.
89.0	53.40	2.85	165.13	152.	288.
89.5	53.70	2.82	163.48	152.	289.
90.0	54.00	2.79	161.83	151.	289.
90.5	54.30	2.77	160.17	150.	290.
91.0	54.60	2.74	158.52	149.	291.
91.5	54.90	2.71	156.87	149.	292.
92.0	55.20	2.68	155.22	148.	293.
92.5	55.50	2.65	153.57	147.	294.
93.0	55.80	2.62	151.92	146.	294.
93.5	56.10	2.59	150.27	146.	295.
94.0	56.40	2.57	148.62	145.	296.
94.5	56.70	2.54	146.96	144.	297.
95.0	57.00	2.51	145.31	143.	297.
95.5	57.30	2.48	143.66	142.	298.
96.0	57.60	2.45	142.01	141.	299.
96.5	57.90	2.42	140.36	140.	300.
97.0	58.20	2.39	138.71	139.	300.
97.5	58.50	2.37	137.06	138.	301.
98.0	58.80	2.34	135.41	137.	302.
98.5	59.10	2.31	133.75	136.	302.
99.0	59.40	2.28	132.10	135.	303.
99.5	59.70	2.25	130.45	134.	304.
100.0	60.00	2.22	128.80	133.	304.
100.5	60.30	2.20	127.15	132.	305.
101.0	60.60	2.17	125.50	131.	306.
101.5	60.90	2.14	123.85	130.	306.
102.0	61.20	2.11	122.19	129.	307.
102.5	61.50	2.08	120.54	128.	308.
103.0	61.80	2.05	118.89	127.	308.
103.5	62.10	2.02	117.24	126.	309.
104.0	62.40	2.00	115.59	125.	310.
104.5	62.70	1.97	113.94	123.	310.
105.0	63.00	1.94	112.29	122.	311.
105.5	63.30	1.91	110.64	121.	311.
106.0	63.60	1.88	108.98	120.	312.
106.5	63.90	1.85	107.33	118.	312.
107.0	64.20	1.82	105.68	117.	313.
107.5	64.50	1.80	104.03	116.	314.
108.0	64.80	1.77	102.38	115.	314.
108.5	65.10	1.74	100.73	113.	315.
109.0	65.40	1.71	99.08	112.	315.
109.5	65.70	1.68	97.43	111.	316.
110.0	66.00	1.65	95.77	109.	316.
110.5	66.30	1.63	94.12	108.	317.
111.0	66.60	1.60	92.47	106.	317.
111.5	66.90	1.57	90.82	105.	318.
112.0	67.20	1.54	89.17	103.	318.
112.5	67.50	1.51	87.52	102.	319.
113.0	67.80	1.48	85.87	101.	319.
113.5	68.10	1.45	84.22	99.	319.
114.0	68.40	1.43	82.56	98.	320.
114.5	68.70	1.40	80.91	96.	320.
115.0	69.00	1.37	79.26	94.	321.

Table 34: Demand for Ice Cream for 1984

PERCENT OF HISTORICAL DEMAND	QUANTITY	PRICE	PRICE INDEX	SALES	AREA
85.0	263.50	2.57	217.25	678.	1551.
85.5	265.05	2.53	213.96	672.	1555.
86.0	266.60	2.50	210.67	665.	1559.
86.5	268.15	2.46	207.38	659.	1563.
87.0	269.70	2.42	204.08	652.	1567.
87.5	271.25	2.38	200.79	645.	1570.
88.0	272.80	2.34	197.50	638.	1574.
88.5	274.35	2.30	194.21	631.	1578.
89.0	275.90	2.26	190.92	624.	1581.
89.5	277.45	2.22	187.63	617.	1585.
90.0	279.00	2.18	184.33	609.	1588.
90.5	280.55	2.14	181.04	602.	1591.
91.0	282.10	2.11	177.75	594.	1595.
91.5	283.65	2.07	174.46	586.	1598.
92.0	285.20	2.03	171.17	578.	1601.
92.5	286.75	1.99	167.88	570.	1604.
93.0	288.30	1.95	164.58	562.	1607.
93.5	289.85	1.91	161.29	554.	1610.
94.0	291.40	1.87	158.00	545.	1613.
94.5	292.95	1.83	154.71	537.	1616.
95.0	294.50	1.79	151.42	528.	1619.
95.5	296.05	1.75	148.13	519.	1622.
96.0	297.60	1.72	144.83	511.	1624.
96.5	299.15	1.68	141.54	502.	1627.
97.0	300.70	1.64	138.25	492.	1630.
97.5	302.25	1.60	134.96	483.	1632.
98.0	303.80	1.56	131.67	474.	1634.
98.5	305.35	1.52	128.38	464.	1637.
99.0	306.90	1.48	125.08	455.	1639.
99.5	308.45	1.44	121.79	445.	1641.
100.0	310.00	1.40	118.50	435.	1644.
100.5	311.55	1.36	115.21	425.	1646.
101.0	313.10	1.33	111.92	415.	1648.
101.5	314.65	1.29	108.63	405.	1650.
102.0	316.20	1.25	105.33	394.	1652.
102.5	317.75	1.21	102.04	384.	1654.
103.0	319.30	1.17	98.75	373.	1656.
103.5	320.85	1.13	95.46	363.	1657.
104.0	322.40	1.09	92.17	352.	1659.
104.5	323.95	1.05	88.88	341.	1661.
105.0	325.50	1.01	85.58	330.	1662.
105.5	327.05	0.97	82.29	319.	1664.
106.0	328.60	0.94	79.00	307.	1665.
106.5	330.15	0.90	75.71	296.	1667.
107.0	331.70	0.86	72.42	284.	1668.
107.5	333.25	0.82	69.12	273.	1670.
108.0	334.80	0.78	65.83	261.	1671.
108.5	336.35	0.74	62.54	249.	1672.
109.0	337.90	0.70	59.25	237.	1673.
109.5	339.45	0.66	55.96	225.	1674.
110.0	341.00	0.62	52.67	213.	1675.
110.5	342.55	0.58	49.38	200.	1676.
111.0	344.10	0.55	46.08	188.	1677.
111.5	345.65	0.51	42.79	175.	1678.
112.0	347.20	0.47	39.50	162.	1678.
112.5	348.75	0.43	36.21	150.	1679.
113.0	350.30	0.39	32.92	137.	1680.
113.5	351.85	0.35	29.63	123.	1680.
114.0	353.40	0.31	26.33	110.	1681.
114.5	354.95	0.27	23.04	97.	1681.
115.0	356.50	0.23	19.75	83.	1682.

Table 35: Demand for Butter for 1984

PERCENT OF HISTORICAL DEMAND	QUANTITY	PRICE	PRICE INDEX	SALES	AREA
85.0	90.95	6.47	149.39	589.	852.
85.5	91.48	6.44	148.60	589.	855.
86.0	92.02	6.40	147.81	589.	859.
86.5	92.55	6.37	147.03	590.	862.
87.0	93.09	6.34	146.24	590.	866.
87.5	93.63	6.30	145.46	590.	869.
88.0	94.16	6.27	144.67	590.	872.
88.5	94.69	6.23	143.88	590.	876.
89.0	95.23	6.20	143.10	590.	879.
89.5	95.76	6.17	142.31	590.	882.
90.0	96.30	6.13	141.52	590.	886.
90.5	96.83	6.10	140.74	590.	889.
91.0	97.37	6.06	139.95	590.	892.
91.5	97.90	6.03	139.17	590.	895.
92.0	98.44	6.00	138.38	590.	899.
92.5	98.97	5.96	137.59	590.	902.
93.0	99.51	5.93	136.81	590.	905.
93.5	100.04	5.89	136.02	590.	908.
94.0	100.58	5.86	135.23	589.	911.
94.5	101.11	5.82	134.45	589.	914.
95.0	101.65	5.79	133.66	589.	918.
95.5	102.18	5.76	132.88	588.	921.
96.0	102.72	5.72	132.09	588.	924.
96.5	103.25	5.69	131.30	587.	927.
97.0	103.79	5.65	130.52	587.	930.
97.5	104.32	5.62	129.73	586.	933.
98.0	104.86	5.59	128.94	586.	936.
98.5	105.39	5.55	128.16	585.	939.
99.0	105.93	5.52	127.37	585.	942.
99.5	106.46	5.48	126.59	584.	945.
100.0	107.00	5.45	125.80	583.	948.
100.5	107.53	5.42	125.01	582.	951.
101.0	108.07	5.38	124.23	582.	953.
101.5	108.60	5.35	123.44	581.	956.
102.0	109.14	5.31	122.65	580.	959.
102.5	109.67	5.28	121.87	579.	962.
103.0	110.21	5.25	121.08	578.	965.
103.5	110.74	5.21	120.30	577.	968.
104.0	111.28	5.18	119.51	576.	970.
104.5	111.81	5.14	118.72	575.	973.
105.0	112.35	5.11	117.94	574.	976.
105.5	112.88	5.08	117.15	573.	979.
106.0	113.42	5.04	116.36	572.	981.
106.5	113.95	5.01	115.58	571.	984.
107.0	114.49	4.97	114.79	569.	987.
107.5	115.02	4.94	114.01	568.	989.
108.0	115.56	4.91	113.22	567.	992.
108.5	116.09	4.87	112.43	566.	995.
109.0	116.63	4.84	111.65	564.	997.
109.5	117.16	4.80	110.86	563.	1000.
110.0	117.70	4.77	110.07	561.	1002.
110.5	118.23	4.73	109.29	560.	1005.
111.0	118.77	4.70	108.50	558.	1007.
111.5	119.30	4.67	107.72	557.	1010.
112.0	119.84	4.63	106.93	555.	1012.
112.5	120.38	4.60	106.14	554.	1015.
113.0	120.91	4.56	105.36	552.	1017.
113.5	121.44	4.53	104.57	550.	1020.
114.0	121.98	4.50	103.78	548.	1022.
114.5	122.51	4.46	103.00	547.	1025.
115.0	123.05	4.43	102.21	545.	1027.

Table 36: Demand for Skim Milk Powder for 1984

PERCENT OF HISTORICAL DEMAND	QUANTITY	PRICE	PRICE INDEX	SALES	AREA
85.0	38.25	7.43	174.05	284.	508.
85.5	38.47	7.36	172.43	283.	510.
86.0	38.70	7.30	170.82	282.	511.
86.5	38.92	7.23	169.21	281.	513.
87.0	39.15	7.16	167.60	280.	515.
87.5	39.38	7.09	165.99	279.	516.
88.0	39.60	7.02	164.38	278.	518.
88.5	39.82	6.95	162.77	277.	519.
89.0	40.05	6.88	161.15	276.	521.
89.5	40.27	6.81	159.54	274.	523.
90.0	40.50	6.75	157.93	273.	524.
90.5	40.72	6.68	156.32	272.	526.
91.0	40.95	6.61	154.71	271.	527.
91.5	41.17	6.54	153.10	269.	529.
92.0	41.40	6.47	151.48	268.	530.
92.5	41.63	6.40	149.87	266.	531.
93.0	41.85	6.33	148.26	265.	533.
93.5	42.07	6.26	146.65	264.	534.
94.0	42.30	6.19	145.04	262.	536.
94.5	42.52	6.13	143.43	261.	537.
95.0	42.75	6.06	141.82	259.	538.
95.5	42.97	5.99	140.20	257.	540.
96.0	43.20	5.92	138.59	256.	541.
96.5	43.42	5.85	136.98	254.	542.
97.0	43.65	5.78	135.37	252.	544.
97.5	43.88	5.71	133.76	251.	545.
98.0	44.10	5.64	132.15	249.	546.
98.5	44.32	5.58	130.53	247.	548.
99.0	44.55	5.51	128.92	245.	549.
99.5	44.77	5.44	127.31	243.	550.
100.0	45.00	5.37	125.70	242.	551.
100.5	45.22	5.30	124.09	240.	553.
101.0	45.45	5.23	122.48	238.	554.
101.5	45.67	5.16	120.87	236.	555.
102.0	45.90	5.09	119.25	234.	556.
102.5	46.13	5.02	117.64	232.	557.
103.0	46.35	4.96	116.03	230.	558.
103.5	46.57	4.89	114.42	228.	559.
104.0	46.80	4.82	112.81	225.	560.
104.5	47.02	4.75	111.20	223.	562.
105.0	47.25	4.68	109.58	221.	563.
105.5	47.47	4.61	107.97	219.	564.
106.0	47.70	4.54	106.36	217.	565.
106.5	47.92	4.47	104.75	214.	566.
107.0	48.15	4.41	103.14	212.	567.
107.5	48.38	4.34	101.53	210.	568.
108.0	48.60	4.27	99.92	207.	569.
108.5	48.82	4.20	98.30	205.	570.
109.0	49.05	4.13	96.69	203.	571.
109.5	49.27	4.06	95.08	200.	571.
110.0	49.50	3.99	93.47	198.	572.
110.5	49.72	3.92	91.86	195.	573.
111.0	49.95	3.85	90.25	193.	574.
111.5	50.17	3.79	88.63	190.	575.
112.0	50.40	3.72	87.02	187.	576.
112.5	50.63	3.65	85.41	185.	577.
113.0	50.85	3.58	83.80	182.	578.
113.5	51.07	3.51	82.19	179.	578.
114.0	51.30	3.44	80.58	177.	579.
114.5	51.52	3.37	78.97	174.	580.
115.0	51.75	3.30	77.35	171.	581.

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